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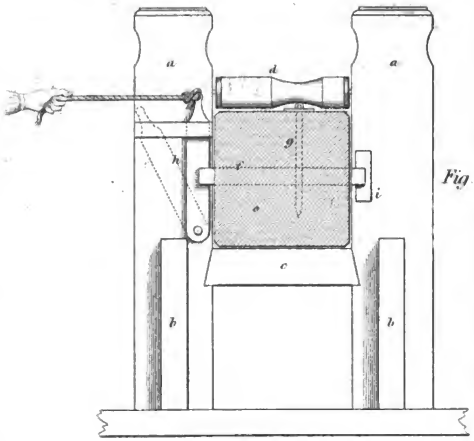

Fig. 4.

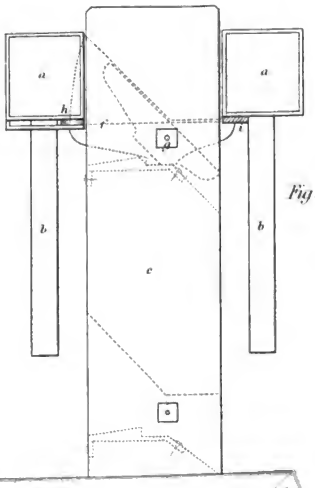

Fig. 5.

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To Captain Blake, with the Author's kind Regards —

DESCRIPTIONS

OF

VARIOUS PLANS FOR THE IMPROVEMENT OF

NAVAL ARCHITECTURE,

WITH ILLUSTRATIVE SKETCHES.

By R. F. S. BLAKE,

OF THE ROYAL DOCK YARD, PORTSMOUTH.

NEW YORK PUBLIC LIBRARY

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1833.

Blake

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PREFACE.

THE following pages contain a description of various improvements in Ship-building, the result of many years' reflection, during my experience as an officer in his Majesty's Dock Yards.

My object in publishing is to record my inventions, which I feel have been productive of advantage to the public service.

If any deficiencies should be found in the style of the work, I beg my readers to judge of it by its practical use, and not by the manner of describing the plans, which is, perhaps, not always strictly accurate.

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The diagrams, it is hoped, will assist in rendering the descriptions clear and intelligible; but as their object is simply to illustrate the plans to which they refer, they are executed without any attention to ornament.

If the publication should succeed in promoting the improvement of the profession, or should tend to the welfare of his Majesty's naval service, my warmest wishes will be gratified.

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CONTENTS.

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DESCRIPTIONS

OF

VARIOUS PLANS FOR THE IMPROVEMENT OF

NAVAL ARCHITECTURE.

Improved Method for converting Timber for Counter and Stern Rails.

Observing the great waste of material on the old method of converting Counter and Stern Rails, pieces of timber of peculiar shape and considerable magnitude, reaching across the stern, as seen in the sketch, *fig.* 1, *plate* I., the former distinguished by *a*, the latter by *b*, forming the plank, as well as an embossed rail, explained by *fig.* 2, I contrived a method of converting them out of straight-sided timber by one round aft mould only, as seen in *fig.* 3, by which means the log or tree that was usually cut up for one rail, produced two, with not one-third the labour to the converter or shipwright; and as every rail consumed a log of timber, on the old plan, a three-deck ship having six, a two-deck

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four, and a frigate two, I presume that a saving of half this number has taken place, on my plan, on every description of ship, built or repaired, since the year 1794, (the time it was first practised,) which must have amounted to many hundreds of logs of oak timber, of the best quality, and, from its shape, always difficult to procure. Concluding, from the measurement of the logs I have seen cut up for the purpose,* it would be a very moderate estimate were I to value the timber saved on each rate ship, at £50. on a three-deck, £30. on a two, and £10. on an average for every description of frigates; this must have made a saving to Government of many thousand pounds since the above mentioned period.

Mem.—From the great length of time this plan had been in practice, the Author's name was forgotten; and a few years since it was presented to the Society of Arts by another person, but was claimed for me by a friend, who was a member, and had witnessed its first introduction.

* For large Ships, pieces of timber, measuring from two to three loads, were usually applied for a single rail.

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Improved Method of converting Timber for Catheads.

When conducting the new works at Deptford Yard, in 1796, we were greatly distressed for Catheads.* The Neptune was retarded in her progress for want of them; and on this account other yards were resorted to for a supply, but without success. I was induced, from this circumstance, to apply my thoughts to obviate this difficulty and inconvenience to the service; and although Catheads, when ships had beakheads, were of a very difficult form to obtain, as may be seen in the sketch, *fig.* 4, *plate* I., I disclosed to the Master Shipwright, (the late Mr. Pollard,) that I had discovered a new method of converting them out of straight-sided timber, (explained by *fig.* 5,) and was en-

* A piece of timber, of very large dimensions, (placed on the bow of the ship for suspending the anchor,) in large ships, of the same scantling in inches as the keel, and about eighteen feet long; half this length is within board, resting on a beam, and taking a thwartship direction; the other half projects without board, and forms an angle with the inner half, of about thirty degrees upward, and forward the same, which made it in the former mode of conversion the most difficult piece in the ship to obtain.

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abled by this means to procure them out of the store of the yard. This mode of conversion, which removed the existing evil, so well suited the natural growth of the timber, that very inconsiderable and less costly pieces, than those that were usually employed, converted them. Many ships have since been provided with Catheads on this principle. The Fame, built at Deptford Yard, by the late Sir Henry Peake, was about to be launched without her Catheads. I was then in Woolwich Yard, and was applied to, to procure them on my new method, which I did, and received the acknowledgments of the Surveyors, for a plan that had afforded so much benefit to the service.

Mem.—This invention was also pirated and nearly wrested from me, by another person, just after its introduction; and at the time the Navy Board was deciding on a reward for the supposed inventor, it was, by accident, recognised by an officer, now in the service, as belonging to me.

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Alteration in the mode of fastening Knees.

In the year 1803, I proposed that the bolt fastenings in the Knees (or substitutes for Knees) which pass through the ship's side, and are attached to the beams of the several principal decks, should be reduced in diameter, as explained by the sketch, *fig.* 6, *plate* I.; that the three lower bolts, distinguished by *a*, *b*, *c*, should decrease in diameter from those above, to make the ship-side fastenings what I considered equal to the beam-arm fastenings: this recommendation was then carried into effect.

This has occasioned a saving of copper on a seventy-four gun-ship of 1 ton 11 cwt. 2 qrs., amounting in value to about £330. Upon the same principle iron bolt staves would be saved, where copper is not required. The total amount of this saving, on the ships which have been built and repaired since the above period, must be great, and any attempt at calculation on my part would be fruitless.

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Substitute for Compass Timber.

From knowing the difficulty that prevailed at this period (1803) for the want of Compass Timber, which retarded the progress of ship building, I proposed (by model) to the Navy Board a method to combine two pieces of straight timber as a substitute for Compass Timber, as described by the sketch of a floor-timber, *fig.* 7, *plate* I., and the scarph, *fig.* 8, which was approved of; and I had the gratification of being told by the Surveyors of the Navy, of that day, that they considered it equal in strength to grown timber. They directed it to be used on every description of ship, not only for the purposes I at first intended, but for every other, even to the futtocks of the frame, as seen *fig.* 9, and it was in consequence used generally; and in Woolwich Yard, the Jason, frigate, had several of the floor timbers made of fir and elm. The Nelson, a *first-rate*, had many of her floor and other timbers made on this principle, and also several on her last repair at Portsmouth Yard, as well as the Vindictive, just undocked. This plan has given great expedition in cases of

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emergency, as well as being attended with a public saving.

Mem.—This mode of making futtock timbers is particularly applicable to fir built ships, as may be seen by examining the above sketch.

Substitute for Cant Floors and Forestep.

In the year 1803, from the same cause as before stated, I presented a plan of a new method for stepping the Foremast, to do away the necessity of cant floor timbers, which were converted from large knee timber, and of a form difficult to procure; and every ship required from four to six in number, as well as another large overgrown piece of timber, used for a fore-step. My plan was, to introduce two small-sided breasthooks, as shewn in *plate* I., *fig.* 10, by *a, a,* laid at a little distance from each other, in wake of the mast; and then laying a short piece of timber fore and aft, of the shape of the main-step, to bear on the breasthooks, as seen by the section, *fig.* 11, and to receive the heel of the mast, as described by *b.* By this method a general bearing was obtained on the body of

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the vessel, affording as much strength for the support of the mast as on the old plan.

At this period many foreign and old ships were repairing with the greatest expedition, and it was desirable they should be made seaworthy with as little expense and loss of time as possible; for this purpose I thought it my duty to present this plan, with a model, to the Navy Board, and I find it has since been introduced into the service.

Prevention of Embezzlement.

About the year 1803, embezzlement of King's stores was carried on to an alarming extent on the River Thames, which I had a great opportunity of knowing, being then in Woolwich Yard; and I also witnessed the very expensive and vexatious litigation that was continually taking place between the Crown and individuals suspected of this crime, particularly in the article of copper, and that the offenders generally escaped justice, by the plea held out of having purchased the article, bearing the King's

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mark, from a ship breaker.* It was, moreover, not unusual for innocent persons to be impli cated, from having marked articles in their possession. To prevent this, I suggested that, on the sale of old King's ships, the purchaser should be obliged to return all copper and other metal into the King's store, at a declared market-price. This recommendation was immediately carried into effect, and has been the occasion, since the above period, (about thirty years) of many thousands of tons being delivered into his Majesty's magazines, which would otherwise have been afloat in the market, subject to all the evils in law-suits, &c. before noticed. A great saving has been realized to Government, by much of this article being fit for use, and re-applied for ship building, which makes it of the same value as new copper, though purchased at the price of old. It may be worthy of remark, that old copper re-manufactured is con-

* Mr. Colquhoun, in his publication on the police of the metropolis, (written about this period,) under the head of Old Stores, observes, that "a very able and penetrating judge, then on the bench, declared publicly in Court, immediately after a trial where a notorious offender (as many notorious offenders do) escaped justice under the cover of his certificates, '*that government had better burn their old stores than suffer them to be the means of generating so many offences.*'"

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sidered to be much more durable than virgin or new. It has also been the means of keeping up a supply of copper without the necessity of contracting; and, in addition to the great saving and convenience to Government, it has been attended with the almost extinction of embezzlement, (as can, no doubt, be ascertained, even at this distant period, from the police;) public morals have been improved, law-suits avoided, and old ships of war undoubtedly sold at an enhanced price, by this accommodation and quick return to the purchaser.

Proposal for constructing Anchor Stocks of Fir.

From the very large consumption of oak timber, converted for Anchor Stocks, amounting at this period (1804) to many hundreds of loads annually, (Woolwich Yard consuming two hundred for the foreign yards,) and from the difficulty of procuring them, (the chief part being obliged to be cut out of four separate logs, instead of two,) and the extra labour and waste of material, I was induced to suggest the converting them out of fir, as shewn in

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fig. 12, *plate* I., by letter *a*, and sent a model to the Navy Board, of a method of carrying it into practice, by employing iron plates (*b*) and oak plank (*c*) in wake of the square and nut of the Anchor, which secured it there as firmly as with the oak. This proposition was accompanied with the recommendation of the Master Shipwright, (the late Mr. Sison,) for its adoption. The objection, I understood, to its being used, was its want of weight, but this might have been easily remedied.

Alteration required in the Form of Ships when constructed of Fir.

On launching the Jason, fir frigate, of thirty-two guns, in Woolwich Yard, my attention was drawn to the great difference of the light, or launching draught of water of that ship, in comparison of the Thames, built of oak by the same lines, the midship sections shewn in *fig.* 13, *plate* I., by *a*, amounting on an average, fore and aft, to two feet and upwards; occasioned, of course, by the difference in the weight of the two species of wood. On

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account of this buoyancy, the Jason, when equipped, was found to require above one hundred tons more iron ballast than the Thames, to make her sea-worthy. I concluded, from this circumstance, there was something wrong in the construction of the fir ship; and thought, that if her body had been so formed, as shewn by the dotted lines, *b*, as to reduce from her capacity a measurement in displacement equal in amount to the extra ballast which she required, to make her swim at the same load water line, *c*, as the oak ship, allowing both to preserve the same form at the seat of water, the two vessels would carry the same weight of ballast and stores, and the fir ship would have an evident advantage of sailing faster, by having less body to carry through the water, with the same canvass to propel her, the resistance being diminished by the reduction of the area of the midship section. As this subject involved with it mathematical questions, I transmitted my ideas to a member of the Navy Board, the late Admiral Thomas Hamilton, a man eminent for his scientific acquirements, who informed me by a letter, (which I have in my possession,) that my opinion was perfectly correct as to the construction of

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fir ships. Whether this suggestion, was acted on, wholly or in part, I have not the means of knowing; but even an approximation to this alteration, by reducing the redundancy of ballast, would be of benefit.

Alteration in the method of securing the Shrouds to the Ship's side.

In the year 1806, I presented a plan to the Navy Board, for altering the mode of channel work, and removing the lower deadeyes and chains. The method I proposed was simple, and attended with many conveniences, and afforded a more general support to the mast, besides saving about five ton weight of iron-work in chains, &c., in a seventy-four gun ship. The lanyards I intended to pass round a substantial circular piece of timber, as shewn by *fig.* 14, *plate* I.; and the section, *fig.* 15, as a substitute for the lower deadeyes placed in the front of the channel, secured by plates, *a*, passing upwards in a mortise through this piece, and secured by the channel bolts, *b*, passing through them: the lower end of the

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plates would be fitted with chain-bolts and preventer-plates, as usual, (but not required to be quite so substantial;) this is explained in the sketch: those plates may be so placed as to completely clear the fire of the gun; and if either of them were shot away in action, a remedy is not so immediately required, as at present, in the case of the chain of the deadeye being injured. I have seen this plan applied to several merchant ships, where it answered well.

Alteration in the system of Framing Ships.

Having through several successful efforts been enabled to remove in part the want of compass and knee-timber, as shewn by the foregoing plans, yet much difficulty still existed in obtaining suitable supplies; and, in consequence of this circumstance ship-building was greatly retarded in its progress at this period, perhaps the most critical in our history; and presuming on my former success, I endeavoured to form a plan for framing ships of war, that would bring into use the whole stock

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of oak timber, that was then lying useless in the several Dock Yards, from its inapplicability to the old method. And after much consideration of the subject, I was enabled (on the 17th and 26th of March, 1806) to present to the Navy Board a drawing and models of a seventy-four gun ship, framed on an entirely new principle, by an arrangement of shortening the floor-timbers one-fourth, and all the other difficult timbers, or futtocks, one-fifth of their usual length; amounting, in the whole, to about 270 in number. By this method, the ordinary supply of compass timber has been found sufficient in proportion to the straight, whereas, on the old plan, not one log in fifty was found applicable to the principal timbers of a seventy-four, or a two-deck ship, and not one in a hundred to a first rate. In proof of the distress that prevailed at this period, I, in my letter to the Navy Board, instanced the Invincible, (the only line-of-battle ship then building in Woolwich Yard,) which had been delayed in her progress for five years, for want of compass timber of sufficient length and roundings; I witnessed part of this plan, as well as my former ones, applied to forward this ship. Here I may remark, that the greatest difficulty

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I had to contend with in arranging my plan, was in abridging the floors and lower futtocks, (which constitute the foundation of the ship,) without compromising their strength; and it affords me great satisfaction to know, that many years' experience of this practice in our ships of war, fully proves the efficacy of this combination of short timbers as a substitute for the old floors, first futtocks and cross chocks, which latter pieces were always procured with much difficulty and expense, but are now dispensed with. I also, at this period, presented a method of strengthening the bilge, by the introduction of side keelson pieces on the ends of the floors, in the bearing of the ship, to remove the necessity of riders in the hold, which, from their very large dimensions and curvature, could only be obtained with the greatest difficulty. In conclusion, I beg to observe, that many of the best shipwrights of the day, whom I consulted on this subject, and whose testimony I have now in my possession, were of the opinion, that a plan, having more for its object the general benefit of the public service, and that more completely attained that end, was never submitted to the consideration of the Navy Board.

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REFERENCE.

Plate II. *Fig.* 1.

Reference to the disposition of the frame of a seventy-four gun ship on the old plan; *a a*, the fourth futtock, not to be procured from its length and compass; *b*, dotted lines shewing the lower deck and beam ends. *Fig.* 2, a part of the midship section; *c*, the floor timber; *d*, the first futtock; *e*, cross chock on the heels of the first futtocks; *f*, the plan of the floor and first futtocks, &c., united as formerly done.

Fig. 3.

Reference to the disposition of the frame of a seventy-four gun ship on my principle; *g g*, timbers, substitutes for the fourth futtock on the old plan, three feet and a half shorter in the heel, or round part; *h*, dotted lines, shewing the lower deck beams, introduced for a comparison with the old plan, to illustrate how much the ship is benefited in strength by my alteration. *Fig.* 4, a part of the midship section; *i*, the floor timbers, seven feet and a half shorter than the old floor timber; *k*, the

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first futtock, three feet nine inches shorter in the head, or round part, than the old first futtocks; *l*, the plan of the floor and first futtocks combined by coaks and bolts, forming the foundation of the ship; *m*, keelson pieces, which I recommended to be placed on the ends of the floor timber, to strengthen the bilge of the ship, and to supersede the riders on the old plan.

Screw Bolts, as a substitute for other Fastenings.

Observing the great consumption of copper bolts on the Rochfort, seventy-four, building in Pembroke Yard, (and those bolts used only as a temporary security, to fasten the planks of the bottom to the timbers, when taken from the boiling kiln,) it suggested itself to me, that this expense of copper could be saved, by substituting Screw Bolts, as *a*, in *fig.* 16, *plate* I., with the plate *b* to work on, which screws would remain until all the other bolts and fastenings in the ship were complete. These screws were then to be removed, and a treenail put in each place, which treenail would be more

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effective in adding strength to the ship, than the copper bolt usually employed. I proposed this plan to the Navy Board, in 1814, who directed a trial to be made on several ships then building in different yards, and also ordered, that, in the respective reports, the saving should be particularly stated. In the year 1815, a report was made of the trial on a forty-six gun frigate, the Diamond, at Chatham, and on the Belleisle, seventy-four, at Pembroke. The officers of Chatham Yard represented that the difference of expence between the screws and bolts on the frigate would be about £570. The report from Pembroke Yard stated, that the saving on eight hundred and eight screws, sent there for the experiment on the Belleisle, was £173. 19*s*. 2*d*., which would amount to £904. for the whole number of screws required for a seventy-four gun-ship. From these, as well as other reports concerning the economy and efficacy of the screws, the plan was ordered to be generally adopted. Concluding from the above official statements, an immense saving has been realized in the article of copper alone, at least ten shillings per ton, upon every ship built and repaired since the above period, which must nearly include every ship in the fleet,

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amounting to an enormous capital. These screws are also applied to other uses, (besides the planking,) in ship-building, to the great advantage of the service; and by which the following materials will be less injured, than by the practice of fastening with bolts and nails; such as ribbands, harpins, cleats to shores, and all the articles for launching, &c.; to this must be added, the saving in iron bolts, nails, wedges, &c. which is perpetual and incalculable. But however great these considerations may be, they are not equivalent to the superior strength which the employment of Screw Bolts gives to the ship by the improved combination of its parts, which can and has been attested by the best practical shipwrights. I may here insert an extract from a letter on the subject, addressed to me by one of our most experienced shipwrights, Mr. Hayne, late Assistant of Portsmouth Yard, dated Feb. 13th, 1830, previous to his leaving the service. "I take this opportunity of giving you my opinion, grounded on actual experience, of the advantages or otherwise of the Screw Bolts introduced by you into the service. It being a fact well established, that the strength and durability of a ship greatly depends on the faying

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surfaces of the component parts being kept closely in contact with each other, for which purpose, nothing that I have seen in practice, has so effectually contributed, as the use of the Screw Bolt introduced by you."

Improved Form for Ship Sterns.

From a very general complaint of weakness in the sterns of our ships of war, and knowing that many methods had been tried, by the application of wood and iron, in various ways, to strengthen them, which only added weight and expence, without benefit, I was induced, in 1815, to offer a plan to the Navy Board, (with models for a seventy-four gun ship and frigate,) which I considered would effectually remove this complaint, and make the stern as secure as any other part of the ship. To effect this, I proposed to remove those cumbrous and expensive transoms, shown by *a, fig.* 17, *plate* I., and in their stead, I recommended that the frame of the ship should be carried round to the stern-post, (as is done with the bow,) and the timbers

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to run as high as the upper counter rail, as shown in *fig.* 18; by this alteration, the hinge or joint, occasioned by the stern timbers terminating at the surface of the wing transom, which caused the weakness, was entirely removed: this was effected by a trifling alteration in the form of the ship's counter, and lifting the extreme breadth line a little abaft; by this means the plank of the bottom could be easily brought to terminate at the second counter, thus carrying up the outside and inside planking, and, by its diagonal direction, trussing the ship's frame, I considered the stern would be as strong as any other part of the ship, and would send easier in a sea, from the counter not being so abrupt, as shown in *fig.* 19, by *b*, and the old form by dotted lines, *c*, and the frame timbers obtained with less difficulty, while the chase guns could be projected and employed to a greater advantage. This plan is applicable to smaller class vessels, and would add much to their safety. In the year 1817 the round stern was introduced, which only differed from mine in removing the counter, and not housing the rudder head, and also giving it the circular form, and removing the quarter galleries; but the ship's timbers and

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frame were carried round to the stern post, as I had suggested in the above plan for improving the strength. In the beginning of the year 1819, I proposed a small alteration on my original idea, by rounding the stern on the quarters, as shewn in *fig.* 20, and the old form by dotted lines, for the purpose of improving the armament, by pointing the guns for quartering or oblique firing, as *d;* the quarter galleries were to remain in their original form and situation, which would preserve the symmetry of the old stern, as was shown by model to the Navy Board, and is now exemplified, in part, on the President and Vindictive.

Much has been recently said and written on the subject of improvements in ships' sterns, and doubts have been raised in the public mind as to the original suggester of the principle of timbering and planking that part of the ship *round,* at the same time preserving the old plan of housing the head of the rudder; but as a proof of my title to the original idea, I simply appeal to the date, (1815,) when I transmitted my models, as exemplified in *plate* I., *figs.* 17, 18, and 19, to the Navy Board, and when no other similar plan had been made public.

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Increased Armament of the Ship's Bow.

HAVING, in the foregoing paper, described the sterns of ships as now in use in our Navy, which are said also to be generally adopted by foreign nations, giving them better means of defence. There can require little argument to convince every reflecting mind, that the Bow, or other extreme of the ship, should be equally well fortified for the purpose of attack, in order to counteract the increased defensive force of the stern. And knowing it to be of vital importance to this country, and a subject of anxious enquiry by some of our most experienced naval characters, particularly those who were then presiding at our Boards, that the Bows of our ships should be so armed, that, in the event of another war, we shall not have to dread the increased force of our enemies' sterns, and render our brave veterans incapable of being the assailants as hitherto; and after making every possible trial on the old formed Bow, I found nothing of importance could be realized on that plan, which is proved by the little good that has been achieved by the same anxious endeavours of others in our several

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Dock Yards; for at best, not one of our modern built ships can present half the force the sterns are capable of doing; but, by changing the figure from a circular to an angular shape, as will be shown hereafter, I found I had not the least difficulty in placing guns in number and force superior to those of the stern, not only in chase, but quartering, and also giving them space and every other accommodation for action. This is practically exemplified in the Vindictive, formed on the principle of a model of a first-rate ship of war, sent by me to the Navy Board, in the year 1827, accompanied with one on the old plan for comparison, as represented in *plate* II., *figures* 5 and 6. It will be seen, in *fig.* 5, that my plan admits of twelve guns being pointed in chase, whilst the old plan, *fig.* 6, presents only four. The ports, which are shown on the bow of the old plan, *fig.* 6, *a b c—a b c*, cannot be used in chase, but only in quartering; in that case, the ship's course must be altered. It will be observed, by the nautical reader, that the increased force proposed by me, the guns are removed at a greater distance from the midships, or the knee of the head and bowsprit, by which means the additional guns can be brought into use,

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when the ship is required to alter her course a point, or even more, from the direct line of chase, and, under such circumstances, the force will be double that of the old Bow; this is considered by officers who have visited the Vindictive, and seen her capabilities, a most important point. A reference to the plans in *plate* II., *fig.* 9, will explain this. By this altered form I found it not at all necessary to interfere with the form of the load-water line, and the symmetry of the ship is universally allowed to be much improved; and, if there is any truth in mathematical rules for ascertaining the resistance of fluids, the angular form will cause less resistance in plunging; and a common observer may, without the aid of science, be convinced of this on reference to *plate* II., *fig.* 7, which represents the half-breadth form at the lower deck of a second-rate or medium class ship; the dotted line, *a*, describes the common form; *b*, the proposed angular one. *Fig.* 8, shows comparative lines at the forecastle. *Fig.* 9, describes the new Bow, with its increased force, from that of the old one, as shown in the former figure; the direction of the shot is delineated, to explain the capability of the chase guns, either

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to cross the Bow at a small distance from the stem, or the shot of the broadside guns when quartering. The letter *c* describes the direction of the keel in the figures.

Metal Lining for the Hawse-Holes.

From constantly observing the rugged state of the ship's bolsters at the Hawse-holes, occasioned by the quick wear of the coarse elm timber, of which they were composed, and which materially injured the cable, and caused the necessity of their being often shifted or renovated, in the year 1815 I sent a bolster to the Navy Board, in this rugged state, as taken from the bow of a cruising frigate, pointing out the necessity of some method being adopted for the preservation of the cables; and I at the same time suggested a plan, and sent a model, of casing the bolster *a*, in *plate* I., *fig.* 21, with metal, as *b*, formed with a bell mouth, by which means the durability of the cable would be insured, by its passing over a smooth polished surface, and, by lessening the friction,

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the anchor would require less power in weighing. The plan was immediately ordered to be fitted on the Curaçoa frigate, and was reported as answering the purpose I intended, of preserving the cable. This plan of using metal at the Hawse-hole is also in practice for chain cables.

A plan for clearing the Lanyards and Dead-eye Chains at the sides of the Ports for the better Training the Guns.

In the year 1818, I suggested a plan to prevent the danger of a ship taking fire by the interruption of the lanyards of the shrouds in wake of the quarter-deck and forecastle guns, an accident not unfrequent in action. I proposed that the dead-eye chains of such shrouds as were connected with the ports, should be carried above the muzzle of the guns, (as shown in *plate* I., *fig.* 22,) by which alteration the artillery might be trained farther forward and aft. This plan was approved of, and recommended by the Navy to the Admiralty Board for general introduction; and it was, in conse-

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quence, ordered for trial on the Newcastle. At the same period, a plan was sent to the Dock Yards for fitting a substitute for the deadeye chains in wake of the *main deck* guns, and to clear them by a span bolt (as shown in *plate* I., *fig.* 23). This method I considered less substantial than the security given to the other deadeyes,* and therefore proposed a method of allowing the chain to run down, as usual; and, by the introduction of a shackle, attached to an eye-bolt in the ship's side, as described by *fig.* 24, the chain may be easily braced so as not to interrupt the gun when trained. This simple application answers every purpose, and gives the shroud equal security with the other, while it is of less expense in fitting, and easier for the workmen than the present plan. It was ordered for trial on the Havannah frigate, in the year 1820, which ship has been lying in ordinary up to the present

* I am confirmed in this opinion by the defects of the Southampton frigate, just returned from India. In a gale which this ship encountered on her passage home, nearly the whole of the chains fitted on the present plan were carried away, and the channels of the ship greatly endangered by the tendency this mode had of raising them; and I think the state of that ship's channel work is a sufficient proof that this method should not be any longer relied on.

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period. And I here beg to call attention to the chain-bolt pointed out in my proposition, and formed with a shoulder, as *a;* this bolt was found, upon a very severe trial, to be equal to the common chain-bolt, with the united strength of the preventer plate and bolt. I am thus particular in describing a bolt-head so formed, because it can be applied to many other highly useful purposes in ship building; and, as here applied, would be attended with considerable saving in the disuse of the preventer plate and bolt. *Fig.* 25, *plate* I., represents another plan of fitting a shroud in wake of the quarter deck port. It consists of a span, with chain attached; its manner of security, setting up, &c., may be better understood by the figures above referred to.

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Iron Steps for Ship's Masts.

From having had frequent occasion to notice the very early decay of the Steps of Ship's Masts, particularly that of the Foremast, from its being converted out of large overgrown timber, I thought, by substituting cast iron, great convenience would be afforded to the service, as well as a considerable saving realized, from the durability of the metal, and removing the necessity of so frequently docking, as well as stripping the mast, to make good these defects. Other minor advantages would accrue from the introduction of metal Steps, and more room would be given in the hold, by the Steps occupying less space, &c., as shown in *plate* I., *fig.* 26, and the plan, *fig.* 27. This I explained, by the models of the several Mast's Steps, sent to the Navy Board in the year 1821. An order was then given to have them fitted on board the Havannah frigate, in dock at Sheerness; but, from her being so far in progress at the time, and the wood Steps in place, it was relinquished for another opportunity. *Figures* 26, and 27, are explanatory of the form required for the Main Step. The

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Fore Step is about the same shape, and is intended to be fitted in the manner pointed out in one of my former plans, *plate* I., *figures* 10 and 11.

Chain Rigging, with the mode of fitting it to Sheer Hulks, &c.

KNOWING it to be an object with Government to substitute chain for cordage, wherever it could be applied advantageously, in the year 1822, the Sheer Hulk at Sheerness, requiring new rigging, I thought it offered a good opportunity for this application, and proposed it to the Navy Board, to which they assented, and directed me to carry it into effect, and, when finished, to send drawings how it was performed, with particular dimensions of chains, &c. &c.

To prevent rope being at all employed, I contrived a very simple method (as shown by *fig.* 28, *plate* I.) of setting up the shrouds and stays, by a sliding bolt, *a*, with a screw at the end, employing only a single nut, *b*, which has holes on its edge for a lever, shifting from one

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to the other; and to secure the shroud, or stay, after it was set up, a forelock was introduced, and the worm protected for further use when occasion required. This plan was ordered generally when the Hulks might require new rigging. The saving of cordage on each Hulk is from eight to ten tons weight, independent of the durability of chain. I at the same time suggested chains for harbour girt lines to the mast-heads, and other uses for ships in ordinary, which were ordered to be adopted.

Plan for securing Ground-ways in Stone Docks.

On the completion of the Stone Docks at Sheerness, in the year 1823, a substantial foundation block or ground-way was required to receive the iron wedges, *a, plate* II., *fig.* 10, to lay the keel-blocks on, and to be so secure as to prevent the possibility of being disturbed by the shock of the battering ram. For this purpose, I contrived a plan of sinking a cast iron coak, (with a square base,) dovetailed into the

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stone-work, as, *b*, leaving a space round it to receive melted lead. This coak was made in a circular form above the stone work, that, when inserted into the block, the underside of the block should rest in part on the projecting angles of the coak and lead, and consolidate the whole. This plan was ordered by the Navy Board to be fitted in the Sheerness, Chatham, and Pembroke Docks: experience has proved its efficiency.

Plan for raising Port-Lids with facility.

A DISTINGUISHED officer being desirous to have a more easy and expeditious method of raising and lowering the Port, which is most important in time of action, I suggested a plan of applying a metal sheave to the ship's side, for the Port-rope to work on, by which two men were able to perform with ease what was usually the work of six: this plan would effect a considerable saving of cordage, and also preserve the lead pipes in the ship's side. In union with the above plan,

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I proposed a method of starting the Port-Lid by means of a handspike, (the same which is in use when fighting the gun,) resting on a chock fitted in the corner of the Port. This plan was tried on board the Glo'ster, in the year 1825, and an official report made of its practical utility. It was then ordered for general adoption, but has since been relinquished, said to be from incurring too much expense; but knowing the importance of the object, I have since thought, that, by substituting a dumb sheave, as shown in *fig.* 15, *plate* III., the rope would have to pass over the same polished curve as that of the sheave, (as described by the sketch,) which would answer nearly the same end, and save the former expense.

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Plan for Barring in the Ports.

I HAVE also contrived a method to supersede the old practice of barring in Ports, *plate* II., *fig.* 11, (which I have been told by many Naval men, was found inconvenient in gun practice, from the weight of the cumbrous pieces of timber now in use, with their appendages of wedges, hooks, &c.,) by the introduction of iron levers, *a, a,* to fix in jaw-cleats, *b, b,* fastened to the spirketting, or inner plank, with a shifting pin to form the pivot, or fulcrum. A chain, *c, c,* fitted with a hook, will be fastened to the end of the lever, to pass through the ring of the port lid, *d, d,* and hooked to a link of the chain, previous to moving the lever, which lever, when acted on and drawn towards the ship's side, will of course close the port lid. The chain, *c, c,* which is intended to hook on the end of the lever, will secure and make the port lid safe. When the Port is in use, the lever and chain can be removed and hung out of the way.

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Breeching-Shackles of a new form.

THE officer, before alluded to, was also desirous of a plan for the immediate disengaging the breeching of the guns, particularly those required for chase, which he considered as most important. For this purpose I contrived a Shackle, instead of the common ring-bolt, as shown in *fig.* 12, *plate* II. This was tried with double shotted guns on board the Glo'ster in 1825, and found to answer; and was, in consequence, ordered for general introduction: but an objection, I have understood, was afterwards made, from two bolts being employed in the same timber (which I think myself of no importance); when this plan was condemned, a clump-headed bolt, with the shackle and forelock bolt, was introduced; but, for many reasons, this would not answer, and was found on trial imperfect. I have recently suggested a shackle with a *nib* bolt, as *fig.* 13, to remove the objectionable forelock, which, in action, would be next to useless: it will also considerably benefit the service by being much more economical. I have the satisfaction to know, that this last plan has stood the test of a severe trial on board the Excellent.

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Alteration in the Heel of the Rudder.

In a plan introduced of late years for preventing a rope being entangled between the rudder and stern-post, I observed that a great inconvenience was likely to arise in the event of a ship carrying away her rudder, and requiring a temporary one, which could not be fitted without the ship being docked, from the heel projecting abaft. I was induced from this circumstance to contrive another very simple method to remove this obstacle, and to effect the same purpose, by admitting the sole of the rudder into a groove formed in the back of the stern-post, below the lower brace, as shown by *fig.* 14, *plate* III. This I presented to the Navy Board in the year 1827, and it was ordered to be adopted.

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Improved Stopper Bolt.

When in Sheerness Yard, in 1820, the Alert brig returned into port from the North Sea station, complaining of the inefficiency of her Stopper Bolts. I had also heard of the like complaint in other ships; the Euryalus frigate, as I was informed by the carpenter of that ship, was nearly lost in the Downs, from the whole of her Stopper Bolts giving way. To endeavour to prevent a recurrence of this accident, I formed a bolt, (*fig.* 16, *plate* III.,) with a shoulder on the fore part of the eye to bear on a small plate, *a*, let into the deck, which most effectually answered the purpose, as I proved by a comparative trial. This plan was applied to the Dædalus frigate, built at Sheerness.

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Chain Stopper to be applied to Chain Cables.

As the economy and use of chain cables is to this country of the utmost importance, every thing connected with their improvement will, no doubt, receive serious consideration; and hearing, from several Naval men, how frequently accidents had occurred from unbitting the chain cable, for the want of a substantial Chain Stopper before the bitts, instead of the rope ones that are now in use, which in all cases do not give sufficient security, I have lately thought that the shoulder-bolt, mentioned by me in a former plan, could be most beneficially employed for this purpose. The way I recommend it should be used is, that three of the thus formed eye-bolts, of about the diameter of the link of the cable, should be driven in the standard of the foremost bitt, *a*, as in *fig.* 14, *plate* II.; two of them to receive a bolt for a vertical one to hinge on, the other to receive a shackle for the same purpose; the end link of the intended Chain Stopper must be placed on the vertical bolt, *b*; the shackle, *c*, will then fall over, and form a clasp to secure the after end of the stopper; the fore-

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most end will have a shackle, *d*, with a nib eye-bolt to attach it to the cable: it will then be in a situation for unbitting, I think, with great safety; judging from the great strength of the bolts, having tried them with immense power, in several situations, under the superintendence of the boatswain of the Yard. The introduction of the shackle is for casting off the stopper when required. The *figure* 14, *plate* II., will better explain it.

Plan for extricating broken Iron Tillers from Rudder Heads.

From hearing of the distress that the Albion, seventy-four, experienced in a gale, from the difficulty of disengaging the iron Tiller, which, from accident, had been rendered useless, (and often experiencing the same difficulty with our ships in harbour,) I considered some plan was requisite for the safety and convenience of the service, when similar accidents occurred, which, at sea, or in action, might be attended with danger to the ship; and for this purpose

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I contrived a method, by introducing a plate or bar of iron, as, *a*, in *fig.* 15, *plate* II., (the latter I think preferable,) under the Tiller, forming a shoulder to bear against its after end; and this bar, being fitted with cheeks, and a cross bolt, *b*, a lever or tackle, or perhaps both, as, *c*, may be applied for instantly pulling the Tiller out. With wood Tillers, a plan to remedy this evil was desirable, but in iron indispensible, and the expence attending it is trifling. This plan was sent by me to the Navy Board.

Improved Mode of fitting spare Deadeyes.

In the year 1826, I suggested to the Navy Board a plan for removing the surplus Deadeyes in the channels of his Majesty's ships. I observed that a seventy-four has at present thirteen to each of her *main* channels, and to the *fore* twelve; and, as it only required nine to receive the shrouds, I proposed to do away these extra Deadeyes and chains, making scores in the respective channels, as, *a a*, *fig.* 16,

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plate II., for receiving, in case of accident, a spare one, (fitted with shackles, for shipping it in an easy and effectual manner,) taken from those usually allowed for the carpenter's store, which could be put in place in much less time than the shroud could be cast off from the disabled Deadeye. For carrying this plan into effect, it is required to place the eye-bolts, *b*, (which are usually driven in the ship's side between the chain-bolts, for the purpose of accommodating or hooking on the spare Deadeyes when wanting,) at the same distance from the score in the channel, so that either of the spare ones shall suit at any situation. I should also recommend to use the shoulder eye-bolt, *c*, to give strength; acting on this rule, a great saving would be made on the several class ships, and a considerable weight and lumber taken from the ship's side. The weight saved of iron-work in a seventy-four would amount to upwards of two tons, and proportionally in vessels of every other class.

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Application of Iron in constructing Ship's Frames.

KNOWING the practice to be successfully adopted in the merchant service, of making the main beams of ships (of heavy burthen) with two iron plates and plank between, securely rivetted, as seen in *fig.* 1 and 2, *plate* III., I considered this plan could with great advantage be made available for frame-timbers; and for steam-vessels it would be more particularly useful, not only from their consuming so much compass timber, which is always with great difficulty procured, but it would be most beneficial in wake of the boilers, where strength is so much required, and it would also add considerable space in the hold for stowage. Our ships of war are unavoidably weakened in their topsides by the port-holes; and, however the heads of the timbers of the Frame are placed to counteract this, yet the two timbers that run between the ports can only be an approximation to a single one, as may be seen by *fig.* 3: on this account, to give aid and strengthen the frame in the topsides, I recommended the use of iron plates being

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placed in the joints of the frame between the timbers, and the frame-bolts to pass through and consolidate them. This proposition was also made to the Navy Board in the year 1826.

Improved Stopper.

A PLAN for the simultaneous letting go the Stopper and Shank Painter; (said by sailors to be of the greatest importance;) which, from its simplicity and certainty in operation, will remove the liability to the frequent accidents and failures known to occur by the present practice. The method I propose is by removing the end of the Stopper, (which is at present hooked at the end of the cathead,) and bringing it to rest on a cleat, placed on the aftside of the cathead, just within the sheave-holes, as, *a*, *fig.* 4, *plate* III., which shows the outside of the ship; from thence it is carried within board, through a tube, *b*, and attached by a ring to a tumbler hook at *c*, *fig.* 5, which

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shows the inside of the ship, the one end of which bears on a pivot lever, *d*: the end of the shank painter is attached to another tumbler hook, *e*, fitted as before described; a small rope, *f*, is then fastened at the end of each lever, first passing the ends through two sheave-holes of a fixed block, *g*, fastened to the gunwale; and, by pulling on the bight of this rope, it causes a simultaneous release of the Stopper and Shank Painter. This will be better understood by the figure. A saving will result from its introduction by its being suited to ships in ordinary, as well as sea service, which at present require different fittings. A trial of this plan has been made on board the Donegal, and approved of, and is now ordered for other ships. The plan is also applicable for disengaging the spare anchors from the ship's side.

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Tumbler Hook for letting go the Sheet of Boat Sails.

THE Tumbler Hook, *a*, *fig.* 17, *plate* II., with a shackle, *b*, to which is attached a line, *c*, is made available for instantly letting fly the sheet of a boat on emergency. This contrivance was ordered to be fitted for the Northern expedition squadron, and also, in 1824, for the King's boats; and, if in more general practice, it would be the means, I have every reason to think, of saving many valuable lives.

Plan for better securing Breeching, and other Bolts.

FROM the very great importance of securing Bolts, for various uses in ship-building, such as Breeching Bolts for guns, and more particularly carronades, which, from the great strain brought on them in action, are frequently known to draw; for the prevention of this, and similar complaints, I tried several

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experiments to ascertain the best possible method of giving them security, and found the one shown in *plate* III., *fig.* 6, by far the most effectual. It consists in forming a screw at the end of the bolt, *a*, and allowing the nut, *b**, to bear securely on a plate, *c*, let into the ship's side, the Bolt end then to be clenched. I proved this by an immense power, consisting of a treble purchase and capstan, with forty-two men at the bars, twelve feet long, which produced no effect in moving it, notwithstanding the lashing of the block drew the ring of the bolt into an oval shape. The one now in practice gave way with the same purchase with only twenty-four men at the bars, although the bolt was remarkably well clenched. This must prove the superiority of the contrivance, and its use, if adopted, cannot fail of being beneficial to the service.

* The nut on the screw in the experiment was made of mixed metal, and will always be required to be of that material on account of corrosion.

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Plan for Pawling a Round-headed Rudder.

From Round-headed Rudders being found difficult to chock or secure, (in the event of carrying away the tiller, or any other casualty,) in order to have a safe and convenient method for this purpose, I contrived a very simple and economical plan in the following manner:— By allowing a strap of iron, *a*, *fig.* 18, *plate* II., to span the Rudder-Head athwartships, and to run down a small distance under the hoops, and to have a projection of about $1\frac{1}{2}$ inch above to form a stop for a Drop-Pawl, *b*, which is made in a frame hinging on a couple of eyebolts driven into the seat transom, *c*, abaft, and bedding itself securely against it. This Pawl is contrived to fall in place instantly when wanted, at other times is hooked up.

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New Mode of fastening the Diagonal Frame of the Ship.

It has always been a cause of regret, since copper sheathing has been introduced on ships' bottoms, that all the fastenings in contact with the copper must, of necessity, be of the same material, at the expence of nearly three times that of the sheathing. This has called forth, from time to time, a variety of plans to protect iron bolts from the influence of the copper, but every attempt hitherto has failed. I have lately suggested a method, by which a very considerable proportion of copper could be saved, by the substitution of iron, effected by the following means:—By not allowing the bolts, in the truss or inner frame, below the orlop deck, including those in the shelf, to penetrate the bottom plank. By this protection of the outer skin, iron bolts could be safely used; and, I think, with benefit to the ship, as great mischief is done to the plank by allowing bolts of so large diameter to pass through and clench on its surface, more particularly as the plank is often of fir or elm; and, it will be observed

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by *fig.* 7, *plate* III., that the bolts in the orlop shelf, *a*, and longitudinal pieces, *b* and *c*, fall at present in the same strake, not averaging more than sixteen inches asunder. This partial bolting rather weakens than strengthens the ship, and hazards the seam in boring off; and for this reason only, even if the alteration effected no saving, the practice ought to be abolished, and those bolts only above the orlop, in the wales and thick stuff, be allowed to pass through and clench on the outer surface. This plan would be the means of saving nearly one-third of the copper used on the ship; and the expence of iron, as a substitute, would not amount to one-tenth of the cost, and no additional labour be required.

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Improved Bucklers to the Hawse-Holes.

In the year 1827, I presented a plan to the Board, when sitting at Portsmouth Yard, for an improved Working and Blind Buckler for the Hawse-Holes, considering the present plan as ineffectual, and often attended with danger. The alteration I suggested was, that the Working Bucklers, instead of being loose, as at present, and fitted with shifting bars, should be hung on hinges, and secured with bolts and forelocks; by this means they are always in place, and could be expeditiously closed on the cable. The substitute for the Blind Buckler is to be formed of a bar of iron, as *a*, in *fig.* 9, *plate* III., fitted with a circular piece of wood, *b*, (rather larger in diameter than the cable-hole in the other Bucklers,) attached to the bar, by a bolt, with a nut and screw: it must then hinge, and be hung up above the upper half of the Working Buckler, to be ready to fall in place when wanted, and secured with a forelock.

Mem.—The hinges of the Half Bucklers should be made of copper; and the circular piece of wood which constitutes the Blind

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Buckler, should have the surface, bearing against the other Bucklers, lined with leather, to prevent leakage.

Method for describing the Arc of a Circle for Beam Moulds, &c.

As several methods had been in use for describing the Arc of a Circle, when the radius, from its length, could not be obtained; and as all those had proved fallacious, with the exception of one, which is uncertain in practice, from the great length of line required to find the intersection for forming the curve, I was induced, from this circumstance, to endeavour to discover a more correct and simple method, as exactness is necessary in ship-building for Beam Moulds, &c. Suppose the round in the middle from the chord or base line, or from *a* to *b*, twelve inches, (*plate* III., *fig.* 10,) the length of the chord ten feet, the half-length, of course, from *a* to *c*, is five feet; a radius is then made of the distance *b* and *c*, describing

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the line, *c d*;* on this line must be set up, perpendicularly from the base line, the round up or distance, *a b*; then divide the distance, *d c*, into as many parts as required, (in the figure is shown three,) then, from the intermediate spots, lines must be struck, as is seen, (by the dotted ones,) to the point *b*; and as many divisions are to be made between the points *b* and *c*, with the dividers, bringing the point at each remove on the divisional line, as explained by the figure. This intersection will give spots for bending a batten to chalk the required curve, which is geometrically correct.

* For Beam Moulds, and the like, the line, *c d*, may be dispensed with, and a perpendicular line substituted.

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Plan for ending the Half-breadth Lines in the Mould Loft.

VARIOUS plans have been used, and a great deal written, on the subject of ending the Half-Breadth Lines, most of which I found tedious and intricate, for which reason I endeavoured to form some method that would be more simple; and, in the year 1805, I introduced a plan, which I have practised ever since on a great variety of ships, and have found it most correct. It will be seen by *fig.* 11, *plate* III., and the explanation given, that the principle is geometrically true: *a*, represents a part of the moulding of the stem taken from the sheer draught; *b*, the rabbet lines circumflexed; *c*, is a line drawn at a right-angle from the rabbet line; *d*, is part of the half-breadth section of the ship at the line *c*; *e*, the middle line, showing the half-breadth of the stem. The point, *f*, is the fore part of the rabbet, which forms a centre for sweeping the quadrant of a circle, the radius equals in inches the thickness of the plank of the bottom; the ship's form, *d*, will of course fall on the back of the circle: this line is then

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ended. As this half-breadth line, *d*, is ended on a circle, how must a half-breadth line be ended which cuts the rabbet line obliquely (as the level line *g*)? The fore and after part of the rabbet must be squared down from the line *g*, (as shown by the dotted lines,) to the half-breadth of the stem on the section of the half-breadth level line *g*, distinguished by *h*; these two spots will be the half of the transverse diameter of an ellipsis, its other half (or the conjugate diameter) will be the thickness of the bottom, formed as described. A few of these elliptical quadrant moulds, for the several class ships' bottoms, may be kept in the mould loft, for the purpose of ending oblique lines. My reason for preferring the level lines, and sections of the frames, is this:—I always place my level lines in the sheer, at the same height at the stem as the water lines, whose sections on the half-breadth are described in the draught of the ship. I take their angle, at the extreme, with a sector or bevel, and apply it to the corresponding half-breadth level line, and chalk it in on the back of the ellipsis; this is also performed at the sections in the body plan, which prevents the trouble of running off any other lines; and as much

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time would be lost in finding the sections of the ellipsis for diagonal or harpin lines, I recommend the forming of what is termed a bearding line, which is a curved line created by producing the half-breadth of the stem, &c., upon the moulding surface of the ship, as explained by the letter *i* on the half-breadth section of *h*; this intersection is squared up on the level line, *g*, in the sheer; and by getting similar intersections on the level lines and sections, and bending a batten, and chalking in the same, the bearding line is produced; at which line, the harpin lines must be considered to end. In laying off the ship, this method of ending the lines forward, as well as aft, will be found true, expeditious, and correct.

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A Method of reducing or enlarging Plans.

GREAT inconvenience and loss of time occurs to the draughtsman by the usual process of reducing or enlarging plans from one scale to another. In my practice I have found nothing that gave so much facility as the following method, which is not only expeditious, but mathematically correct. It is by assuming a point at pleasure on the original plan, as *a*, in *fig.* 12, *plate* III, from thence drawing radiated lines. The figure represents the Knee of the head, on a quarter of an inch scale, and is required to be reduced to half its size, or one-eighth of an inch to a foot; to obtain this, the distance between the original and the focus point, measured on the radiated lines, must be divided into equal parts, and a line drawn through these dividing points will form the reduced figure. If the plan is to be enlarged, the radiated or dotted lines must be produced from the original to a proportionate extent; this method is particularly applicable to irregular figures, such as maps, charts, &c.

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Plan for the better Seasoning of Plank on the Ship's Side.

From a knowledge of the great benefit that has been derived from the modern practice of temporarily fastening the oak plank of the lower decks of our line of battle ships, which are (previously to caulking) taken up to have their joints closed and permanently fastened, after being allowed a reasonable time for seasoning, I thought, if this precaution was necessary with foreign plank taken from the seasoning shed, a much greater advantage would arise from the same practice being pursued with the outside planking of ships, building or under repair, as a large proportion of this material is generally cut from logs indiscriminately, particularly for forward and aft. For this reason I was induced to recommend to the Navy Board the adoption of the following method; and as screws are always used for temporary fastenings, they offer a great convenience for the purpose of seasoning this plank, which is intended to commence with the frame; and when the usual time has elapsed for this process, the screws are then removed, the holes in the ship's frame

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plugged up, and the edges of the plank closed, when it is ready to receive its customary fastenings. This would add very little to the expense in the first instance, and would ultimately be attended with great benefit, and add much to their strength and durability by compact and substantial caulking, which would not require to be repeated more than once in two or three years, instead of, as at present, every year, or sometimes less. On our well-conditioned ships in ordinary, this plan would (I have reason to believe) be attended with great public saving in labour and materials, and with much less injury to the ship; as it often happens that, from enlarged seams, ships are not sea-worthy, and are, at a very heavy expense, obliged to have their planks shifted.

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Alteration in Fitting the Bed-places in Troop Ships.

On fitting the Romney, troop-ship, at Sheerness, I observed, from the great space occupied on the lower deck by the fixed bed-places, little room was left for the messing of the troops; it suggested itself to me that the bed-places could be made available (by a trifling alteration) for the purpose of messing them in great comfort. To obtain this, I proposed that the bottom boards of the upper tier of bed-places should be laid athwart-ships, and to divide the six feet length into three separate panels, the middle one to remain a fixture, the other two to turn up against the stanchions, secured by a button. A table was thus left, and a space for the soldiers to sit on each side; and having a deal, or the head-board, contrived to turn down at each opening, seats were provided for eight men, or as many troops as the bed-places contained. I sent a model to the Navy Board, and it was approved, and ordered to be fitted for trial in the same ship.

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Iron Bedsteads proposed for Troop Ships.

At the same period, by the directions of the Admiralty, I also prepared a drawing, on the same principle, for forming the bed-places of iron, in the manner of those used in barracks, and contrived them to hinge, and turn up, so as to have the decks clear.

Plan for preventing the occurrence of Fire in the Spirit Room.

On hearing of the accident of the Kent, East Indiaman, being totally burnt, by fire communicating from the candle in drawing spirits, I thought, as a precautionary measure, it would be desirable for ships of war to have enclosures for lamps, to convey with safety light to the Spirit Room; the space for this purpose I recommended to be taken from the Captain's hanging store room on one side, and from the Purser's cheese room (as it is called) on the other, both under the orlop deck. The small

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space taken from those places could cause no inconvenience, and the entrance scuttles would be in a safe situation, and out of the way of interruption. I sent a drawing to the Navy Board, with every particular how to carry this into effect in a line of battle ship.

On consulting an experienced Naval Officer previous to my sending the above plan to the Board, he informed me he considered light-rooms for this purpose almost as desirable as for the magazines.

Improved Windsails for Ships in Ordinary.

When in Sheerness Yard, from my duty being chiefly afloat, I lost no opportunity of endeavouring to preserve the good condition of that extensive ordinary; and after some experience I saw the necessity of an improvement in ventilating the ships by Windsails, and took some pains to perfect what may be called a Drum-Windsail, (as shewn in *plate* III. *fig.* 13,) made of canvas, strained on a slight frame, and painted, leaving an aperture as usual to admit air, as *d*; this was attached to a revolving hood, *b*, travelling

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on a frame, *c*, to which the whole was suspended by a tackle, *d*. By this contrivance the drum was easily trimmed, as the wind varied; it could also be raised and lowered, and made to secure itself so as to prevent damp or wet penetrating the ship: the dotted lines, *e*, represent the top of the temporary roof. This plan was immediately adopted, to the benefit, I trust, of his Majesty's fleet.

Temporary Port-Lids for Ships in Ordinary.

I MADE other improvements for the same benefit, such as perfecting temporary ports, and contriving the apparatus for raising and lowering them expeditiously, and wedging them in. This plan was also adopted.

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Saving of Cordage by substituting Chain for Backstays.

In the year 1821, for the purpose of saving cordage, and giving greater support to the top-mast, I found that the backstays could very advantageously be made of chain, from the channels to a few feet above the rim of the top; from thence upwards to be of rope, as usual. By this method the topmast shrouds and back-stays would have the same length of rope for tension; and by allowing the chain of the breast backstays to bear against an iron fender on the rim of the top, a support would be given to the top-mast, equal to that usually afforded to the lower mast of a single masted vessel, as the upper part of the chain bearing against the top may be supposed to represent the side of the vessel. In recommending this proposition for trial, I suggested the method of carrying it into effect, with a reduction in the number of the topmast shrouds, as being unnecessary. The introduction of this plan would be attended with considerable saving of rope, as the back-stays are known to be particularly subject to wear, and are obliged to be frequently renewed.

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Enlarged Bread-Room for Frigates.

FINDING that much inconvenience was experienced in the larger frigates in the stowage of bread, it struck me that the lower deck might be raised two, or even three feet, (in a situation that would not interfere with any of the arrangements of the ship,) under the traversing part of the tiller, leaving the officers' cabins, &c. undisturbed, which would increase the stowage above one-fourth more than at present. This I presented to the Board in the year 1830.

A Plan for connecting the Beams to the Ship's Side.

VARIOUS plans have been suggested and employed for the union of the beams to the ship's side, and to prevent the lateral racking or angular motion of the ship; to provide against this evil, I offer the following plan, shown in *plate* III. *fig.* 17: By two iron plates, formed with a truss and ear, or projecting piece, to receive the upper bolt in the beam, as *a*, let into

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the side of the lower deck beam, *b*, and the chock, *c*, under the beam, and fastened by bolts passing from one knee to the other. (The chock, *c*, will be bolted to the ship's side previous to the bolting the knees.) By the form given to the plate-knees, the bolts passing through the beam arm will be so distributed as not to have a tendency to split the beam when strained, as has been found on former occasions when plate-knees have been used. A separate iron lodging-knee is intended to be brought on each side of the beam, formed with ears or lugs to suit the holes in the plate-knees, as shown by *d*. Nearly a similar formed plate-knee will also be required for the orlop beam on each side, as shown at *e*, as well as a small chock under the beam, as shown by *f* on the figure, omitting the lodging-knees on each side of the beam, they not being required in this place. By making the plate-knees of the form described, they will be found to answer the wear of many ships, and will have the advantage of being more economical in material, and saving smiths' labour. I also estimate a considerable saving in copper bolt staves. By this combination, I have every reason to think that this plan, if carried into effect, would render the ship immoveable.

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A Plan for the better Security of Iron Lodging Knees.

WHILST on the subject of iron knees, I would propose a plan for securing a common iron lodging knee, which would not only reduce its weight, but make it more efficacious. *Plate* III. *fig.* 18, represents part of the plan of the deck; *a* the ship's side, *b* the beam end, *c* the lodging knee, *d* represents a plate placed at the side of the lodging knee, and which admits one or more of the bolts of the knee, *e e*, to pass through it, and clench on the plate; this plate extends into midships, and will also be bolted to the beam-arm. It will be evident to the professional reader, that the bolts of the lodging knee connected with the plate will be supported in the same manner as the chain-bolt of the ship's dead-eye chains is by the preventer plate and bolt. This plan would be found particularly useful for old ships, as well for vessels with slight beams, as yachts, &c.

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Description of Blake's Patent Pivot Fid.

Much ingenuity has been shown by a variety of inventions relative to the fid, for facilitating the striking of the topmast, which fully proves the necessity and usefulness of endeavouring to establish a permanent one for this important object. The one I have lately invented, and obtained a patent for, is simple in principle, certain in its operation, combined with safety and economy; and (which I trust will be its recommendation,) it is suited for every description of ship, as well for the mercantile service as the navy. The principle is also applicable to the running bowsprits of cutters, &c. *Plate* IV. is illustrative of the plan.

Fig. 1, *a a*, is a part of the section of the topmast; the part shaded black is the fid-hole or mortice: *f* is the fid: *i* is a pin or pivot, which supports it in the fid-hole, and on which it turns: *m* is the fid-plate: *g* is a fixed bearing plate on the trestle-tree, (or chock on the trestle-tree, as the case may be): *h* is a moveable bearing plate on the opposite side; these two plates the fid, *f*, will bear on. It will be observed that the moveable

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plate, *h*, is an inclined plane, and the end of the fid bearing on it is cut to a corresponding inclination, the object of which is to facilitate the removal of the moveable plate, *h*, when it is required to strike the topmast. The compasses, *q*, are placed to show the mode of obtaining the arc, *r*: the distance from the centre of the pin, *i*, to the underside of the fid-plate, *m*, in a perpendicular direction, must be ascertained, and will be the radius for the arc, *r*: this arc, *r*, must extend sufficiently near the lower part of the fid to enable it to take the position described by the dotted lines, *l*, or the situation it will require to be in when the topmast is lowered. Now it is evident, that the pin or pivot being on one side of the centre line, *s*, if the topmast be raised so as to lift the ends of the fid sufficiently above the bearing plates, *g*, *h*, the end of the fid farthest from the pin or pivot will drop, and the other end will rise, till the whole fid is brought within the fid-hole, and assumes the position shown by the dotted lines, *l*, in this figure, and the topmast may be raised or lowered at pleasure without impediment.

But as it is very important that sailors should possess the power of lowering the topmast, on

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certain occasions, without first slacking the rigging for the purpose of raising the fid from its bearings, a contrivance for this purpose is shown at *k*, in *fig.* 2, which figure represents a front elevation of a part of the mast-head, and heel or lower part of a topmast. And I here beg to state, that similar letters of reference are used to denote similar parts in *figs.* 1, 2, and 3; wherefore I shall only deem it necessary particularly to describe the part marked *k*, in this figure, which is, in fact, simply a groove cut in the inner side of the trestle-tree, (or, in part, in the chock on the trestle-tree, as the case may be,) sufficient to allow the end of the fid, *f*, to fall into the position shown by the dotted lines, *l*, as soon as the bearing plate, *h*, is removed, without the necessity of raising the topmast in the slightest degree. And I here beg to observe, that as the weight of the topmast is sustained by the lining plate, *m*, bearing on the straight part of the fid, on its upper side, the pin, *i*, is only intended to keep the fid in place, and for the operation of turning on, when required.

Fig. 2. *a* represents the front of the lower part of the topmast: *b* the head of the lower mast: *c* the cap: *dd* the trestle-trees: *ee* chocks

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to receive the plates for the fid to rest on, (which chocks will often be required,) the upper side of which to correspond with that of the foremost cross-tree : *f* the fid, extending across the heel to receive the weight of the topmast, bearing on a fixed plate, *g*, secured to the chock, *e*, on one side, and, on the opposite, on a moveable plate, *h*, which is also bearing on the chock, *e*; this will be better seen in *fig.* 3.

Fig. 3 represents a plan corresponding with the former figure. *a* the section of the topmast: *b* the head of the mast: *dd* the trestle-trees: *e e* the chocks, the upper side of which forms a surface fair with the cross-tree, *n*, and receives the fixed plate, *g*, on one side, and the moveable plate, *h*, on the other, for the fid, *f*, to bear on. It will be observed in this figure, that the plate, *h*, works on a pin or pivot, situated a few inches abaft the fid; and when it is required to strike the mast, this bar will be removed by a power applied to the foremost end, as shown in this figure, and will be forced clear of the end of the fid, or in the position shown by the dotted lines, *o*. This moveable plate, *h*, will be kept in place by a pawl, *p*, secured by a pin attached to a chain; or a jaw-cleat might be preferable, with the pin

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passing through it and the end of the moving plate, *h*.

The two following figures are intended to show the same principle applied to running bowsprits, for cutters, &c.

Fig. 4. *a a* represents the front of the bowsprit bitts: *b b* the standard knees: *c* the chock between the bitts, on which the bowsprit bears: *d* the roller: *e* the section of the end of the bowsprit: *f* the fid: *g* the pin or bolt on which the fid turns, the head of which is to be formed with a ring or eye, for the convenience of moving the fid from one reef to the other: *h* the moveable bar which the fid bears on, on one side, and on the other on a fixed plate, *i*. The process of moving the bar, *h*, is as before described for the topmast.

Fig. 5 represents a plan of *fig.* 4, the reference letters denoting similar parts in each. The principle is precisely the same as explained in the topmast, only the fid, *f*, is formed with a shoulder, to more readily find its situation in shifting from one reef mortice to the other; but if a fid to each mortice should be preferred, this shoulder, of course, will be omitted.

By this improvement the fid is attached to the spar with which it is to be used, or held

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within the fid-hole, and turning or balancing on a centre or pivot, and resting on a moveable bearing plate, in such a manner, that, by taking away the support from, and lowering the end of the fid, both ends are brought completely within the fid-hole, and no impediment offered to the raising, lowering, or sliding in or out, as the case may be, of the spar.

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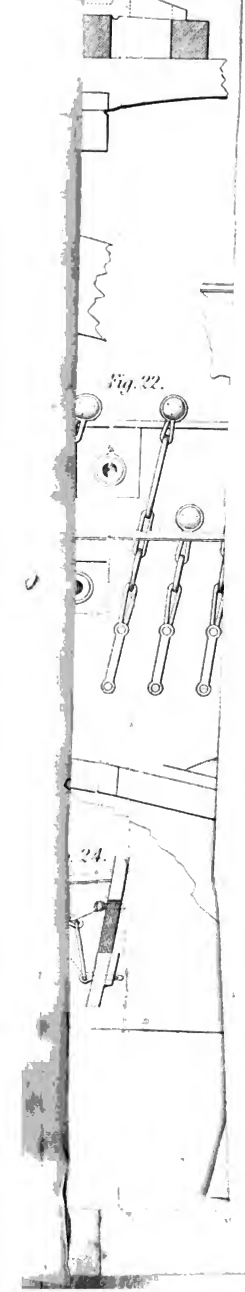

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AN APOLOGY

FOR

ENGLISH SHIP-BUILDERS;

SHOWING THAT

IT IS NOT NECESSARY

THE

COUNTRY SHOULD LOOK TO THE NAVY

FOR

Naval Architects.

The First Lord of the Admiralty stated, in the House of Commons, that he was advised and firmly persuaded that a Naval Captain is more competent than any individual he could possibly select from the Ship-building Department, to fill the office of Surveyor of the Navy.—Vide *Debates on the Navy Estimates*, June 29, 1832 (page 5).

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AN APOLOGY,

ETC. ETC. ETC.

THE recent dismissal of *Sir Robert Seppings* from the office of Surveyor of the Navy, and the appointment of *Captain Symonds*, R.N. as his successor, have produced a powerful sensation throughout the Government ship-building department, and were the subjects of an animated discussion in the House of Commons on the 29th of June last, when the First Lord of the Admiralty moved for navy supplies, for officers' salaries, and contingent expenses.

Mr. Hume took that opportunity of animadverting on the extraordinary circumstance of placing a captain in the navy at the head of a professional department, on the efficiency of which the naval supremacy of Great Britain so intimately depends; and he thought it was to be lamented, that while there are so many individuals in the service eminent as practical shipwrights, besides a school of naval architecture, the members of which have been prosecuting the study of naval science and attending to the business of our dock-yards for nearly *twenty-two years*, the country must now look to the *Navy* for naval architects!—Several other members, whose opinions on such matters are entitled to much weight, took the same view of the question as the honourable member for Middlesex.

As the sense of the House on the occasion alluded to may be best conveyed by giving the debates, they are here reprinted,* as published in the *Mirror of Parliament*.

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* *Debate on the Appointment and Qualifications of a Surveyor of His Majesty's Navy, in the House of Commons, on the 29th of June* 1832.

Mr. HUME said, when this vote was formerly before the House, some observations were made respecting the appointment of Captain Symonds, as surveyor of the navy, in preference to all those persons who have been for many years pursuing their studies in the School of Naval Architecture, and who have naturally looked up to the appointment of this office as the reward for their

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It will be seen that Sir James Graham said, in explanation of the course he had adopted in appointing Captain Symonds, "*I am advised and firmly persuaded, that Captain Symonds is more competent to fill that office than any other gentleman I could possibly select.*"

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assiduous application to that science. The parties who feel themselves interested in the proceedings of the right hon. baronet are entitled to know whether the supercession, which they consider themselves to have suffered by an officer being called from the navy to fill that situation, is to be regarded by them as the result of a determination to close the situation of surveyor of the navy against them; and whether the other situations, which were originally held out to them as inducements to devote themselves to the study of naval architecture, are also for the future to be filled by naval officers. No man who looks back to the report of 1806, pointing out the comparative state of the naval architecture of France and England, can doubt that England is at least equal in that science to France, or any other nation; and to keep up that science was the purpose for which the Naval School was formed. But when I look back to the advertisements of that period, inviting persons to offer themselves, as members for that establishment, and when I read the preliminary information they were required to possess, and consider the expense and the severe examination they underwent before admission, I cannot help regretting that any circumstance should have occurred to induce Government to place that class of intelligent and able men, who accepted these invitations, in the background. The inducements held out to them have been withdrawn; and now, after devoting their whole time for sixteen or eighteen years to the service, they are struck out from the natural reward of their severe application to study, and the public is deprived of the use of that establishment. I shall not at this hour occupy any further time of the committee, but shall take the earliest opportunity to lay on the table some documents which will show the justice of the complaints made by these individuals of the conduct which the right hon. baronet has pursued, and the statement which he formerly made with regard to them.

Sir J. GRAHAM.— I am afraid the hon. member has misunderstood what I said upon this subject on a former occasion. I did not say that these individuals were shut out from the office of surveyor of the navy; but I only stated that there was not one of them fitted for that situation. The order in council, by which they hold their offices, declares that they shall be eligible for all the situations therein enumerated; but, of course, they must possess the necessary qualifications. The hon. gentleman is wrong when he speaks of the expense they are put to to obtain their education. It is true their education is very expensive; but then that expense is borne by the public, inasmuch as they are boarded, lodged, and educated, by the public. What is the case? *Are not all these gentlemen now holding situations* under the Government? The situations for which they are eligible were enumerated in the order of council; a proportion of these situations has been abolished. Among those for which they are now eligible, is the surveyor of the navy, the second surveyor is abolished; the next office is that of master shipwright; then civil engineer; and next, assistant master-shipwright. *There are three of these gentlemen master shipwrights* (one of them has lately died), and several others are acting *as assistants*. Now the order in council, which renders these gentlemen eligible to be appointed surveyor of the

When it is thus stated before the Representatives of the Nation, that a whole body of public servants, professionally educated, are less competent to fill an office of responsibility in their own department than an amateur ship-builder, it becomes a serious charge indeed; and they whose

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navy, was dated only in 1809; and *these gentlemen have not been above sixteen years in the service, seven years of which was of course during their apprenticeship, therefore they have not much reason to complain.*

Sir BYAM MARTIN.—I have heard with great astonishment the explanation of the right hon. baronet. I am almost at a loss to imagine what degree of qualification is requisite for the situation of surveyor of the navy, which these young men do not possess. Many of them have been seventeen, eighteen, and even nineteen years following the duties of a shipwright, and yet the right hon. baronet declares that none of them are competent to fill the situation of surveyor, although they are all known to be highly-gifted persons, while, at the same time, the right hon. baronet has appointed a gentleman to that situation, who, though of acknowledged abilities, has no practical knowledge of the building of a ship. *The very ship he is now employed to build, he was unable to make the necessary calculation for; and he actually sent to the Navy Board to ask them to make the calculation, so utterly incapable was he of doing it himself.* But if the right hon. baronet could not find any of these young men qualified to fill that situation, why overlook the master shipwrights in the dock-yards, many of whom are men possessing the highest talent in their profession, and who have been, some of them, following its practical duties for forty years, while the person now filling that situation never has known, nor could by possibility know, anything of the construction of a ship? He may prepare a model or a drawing of one, and so may many honourable gentlemen in this House; but he may do this without knowing how to put the ship together, for which I know Captain Symonds to be entirely unfit. I beg to ask the right hon. baronet whether it is intended that the person who is to fill the office of storekeeper-general is to be a naval officer or not. I understand not. The person who has been appointed (Mr. Dundas), I think, must never have seen a ship in his life, and yet he is the person who is to provide all the rigging, sails, and stores, for the navy. It is very true Mr. Dundas may refer to the Admiralty Board, under the new arrangement, but the service must inevitably be deranged in case of the absence of the party to whom this reference is made, because Mr. Dundas is himself utterly unable to decide the many questions that must necessarily come before him in the course of his official duties.

Sir J. GRAHAM.—I can assure the hon. baronet that I have a very high respect for his opinion and his judgment on subjects of this kind; but, still, without evincing any disrespect to the hon. and gallant officer, I must say that I have the advantage of as good advice and of as high professional character as any which the hon. baronet can possibly possess. In the appointment of Captain Symonds, I have acted *in strict adherence to what I conceived to be for the interest of the navy.* The hon. baronet says, that Captain Symonds is not competent to perform the duties of the office to which he has been appointed; I, on the contrary, am advised and firmly persuaded that *Captain Symonds is more competent than any other gentleman I could possibly select.* He was perfectly unknown to me, except in his profession, and I have selected him on account of the

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reputation is thus involved, are loudly called upon, by every feeling which ought to actuate honourable minds, to endeavour, by proper means, to exonerate themselves from so humiliating a reflection.

It must be remembered, that the right hon. baronet, who thinks so

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inquiries which have been made, and on account of the highly-approved ships which Captain Symonds has built. But I am perfectly ready to admit that the merits of this appointment are about to be put to what is the fairest test. There is a ship now ready for sea, built under his own immediate inspection, and I am quite willing that the merits of the appointment should rest upon the fate of that experiment. I am quite confident that, when I shall meet the hon. and gallant officer again on the navy estimates of next session, he will admit that the result of that experiment has proved that this appointment was made most wisely, and that, on the whole, my humble judgment was correct in selecting a fit person to fill that situation. I am also equally confident that the hon. and gallant officer will be sorry for having used the expression that Captain Symonds was not fit to fill the situation. With respect to the appointment of the office of storekeeper-general, I beg to say that I was exceedingly struck both with the intelligence and industry of the gentleman whom I have selected, and whom I thought quite competent to fill the office. The hon. and gallant officer has anticipated the answer which very naturally suggested itself, with regard to the profession of the person appointed to the situation of Storekeeper-general. It is true that he is not a naval officer, but the Lords of the Admiralty will always be presiding over him, and in all professional points will be able to direct and advise with him. What I said with respect to the appointment of Captain Symonds, I am also prepared to say, with regard to the new system which has been introduced in the Navy department of the service, I shall be ready to appeal to the result of experience as the test of its merits; and by the time the Navy Estimates shall come before this House in the next Session of Parliament, the experiment will have been fairly tried; and, if it should succeed, I have not the least doubt that the hon. and gallant officer will most readily honour me with his approbation.

Sir Byam Martin.—I will admit the experiment to be as perfect as the right hon. baronet can desire it to be; I am not speaking of Captain Symonds's ability to perfect a plan or model, for that I will allow he can do; but I am speaking of the duties of the Surveyor of the Navy, who has to direct the manner of fastening the timbers and putting the ships together. Now, with respect to the ship which has lately been built, Captain Symonds had no more to do with putting that ship together than I had; and I repeat that Captain Symonds has no knowledge of the duties of a practical ship-builder.

Sir J. Graham.—*I do not believe that the Surveyor of the Navy is required to be a practical ship-builder.* It may as well be said that a Civil Engineer must be a practical stonemason. I admit that it is his duty to superintend the master shipwrights; but Mr. Lang, the shipwright, would superintend the *mechanical* part of it, who is under the control of Captain Symonds, as are all the masters in the yard. But that is not by any means his most important duty. I consider that *the application and economy of labour, the discipline of the dock-yard,* and the adjustment of the *whole scheme of labour,* are all duties intimately connected with the office of surveyor. But I must state my objection to place a shipwright in

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unfavourably of the professional pretensions of dock-yard officers, is not only at the head of the Naval Administration, but a member of the House of Commons, and a Cabinet Minister!—if, therefore, he be under the influence of erroneous impressions, the Government ship-building depart-

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the situation of Surveyor of the Navy; *that objection is, that a person who has himself been a shipwright, would necessarily have too close a connexion* with the other shipwrights of the yard, to enable him to exercise that control over them which the public interests may make it requisite should be exercised; and wherever this salutary authority is relaxed, abuses and irregularities are always sure to be the consequence.

Sir G. COCKBURN.—Sir, I am very glad, at all events, that it has been ascertained from the right hon. baronet that he has not quite thrown the pupils of the Naval School overboard. I do believe, with my hon. friend, the member for Middlesex, that a more valuable class of persons cannot be found. I know several of them; and the pains they have taken in studying their duties have been very great. With respect to the expense they have been put to in their education, it appears to me that the right hon. baronet mistook what the hon. member for Middlesex said. What I understood him to say was, that these persons were put to considerable expense acquiring that degree of education which it was necessary they should possess before being admitted into the college. These individuals are, in my judgment, a great deal more fit to be appointed to the office of surveyor of the navy than Captain Symonds. I have the honour to know that gentleman, and there is not a better sailor in existence, but that is not a sufficient qualification for surveyor of the navy. *Hitherto it has been deemed necessary that the surveyor of the navy should be the actual superintendent of every thing done in the building of a ship, and that he should be able not only to tell the master shipwrights that they are doing wrong in putting together the timbers, but also to have a knowledge of the scientific and practical parts, sufficient to enable him to instruct them in the proper performance of their duties.* I should have been glad to perceive the MASTER SHIPWRIGHTS promoted, and I think that it would have been much more satisfactory if one of them had been appointed in the situation of surveyor, instead of taking Captain Symonds from the navy, and appointing him who is reported not fit for the situation; supposing, indeed, the situation to require him to discharge those duties which I have just stated. I have heard of his applying to the navy board to give him an estimate of the ship he has built; and I believe, likewise, that *he is not in the practice of drawing the plan of a ship. I know that, when he first came to the Admiralty, he was obliged to have assistance in that respect.* He certainly did build a very good sloop of war, but it must be in the knowledge of the right hon. baronet, as it is in the knowledge of Sir Thomas Hardy, that the Columbine was by no means superior to other sloops; not of that general superiority sufficient to give a claim to her builder to be placed over the heads of persons who have built other ships. It is true, that he afterwards built a yacht, which was much approved of; and these are the only two testimonials which Captain Symonds has yet produced, who has been nevertheless appointed to a situation to the prejudice of Sir Robert Seppings who has rendered the most valuable practical services to his country of any man living. With respect to the vote now proposed, I certainly have no objection to make to it, as it only provides for the necessary expenses of the

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ment may fall a sacrifice to his misapprehension. We cannot, for an instant, suppose that Sir James Graham could have appointed a naval officer to the situation of surveyor of the navy, for the mere purpose of patronage. On the contrary, we look up to him as a man of high and

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service; but when the vote for superannuation shall come again before the House, I shall avail myself of the opportunity to state fully my objections to the removal of persons in every way practically qualified to discharge their duties, in order to make room for the appointment of others, who have never had the advantage of any practical instruction in shipbuilding.

Sir G. WARRENDER.—I am anxious to take this opportunity of bearing my humble testimony to the great merits and excellent public services of Sir R. Seppings. I do not rise to object to the appointment of Captain Symonds, because I believe him to be a man of genius. I have understood from many naval officers, that he is a man of genius, and I am not here to contend that an appointment may not be conferred on such a man. But I confess I have heard with some surprise and great regret from the right hon. baronet, that all those gentlemen who have been educated at a great expense to the public, and many of whom are known to possess great talent, furnishing among them men of intelligence, and, as I believe, quite capable to fill the office of surveyor of the navy; I say, Sir, that *I regret extremely to hear the right hon. baronet state that not one of those officers is capable of filling that situation.* At the same time, I certainly do not say that there may not be good reasons, in consequence of the genius displayed by Captain Symonds, for his appointment, and for passing over those other persons. I had, however, expected to hear the very reverse of what has fallen from the right hon. baronet with respect to those individuals, and had hoped that we might have looked with perfect confidence to that body of deserving men, for persons in every way fitted to fill the situation of surveyor of the navy. But, Sir, I rose chiefly to bear my testimony to the merits of Sir Robert Seppings, for the many useful discoveries and improvements he has made.

Lord Viscount INGESTRIE.—I perfectly agree with the right hon. baronet who has just sat down, as to the merits and talents possessed by many of those gentlemen who have pursued their studies at the naval college, as it happens to lie within my own personal knowledge that many of them are eminent in their profession, and I regard it as a very great hardship to those persons that they should be treated as they have been by the right hon. baronet opposite; and *more especially that he should have declared their incompetency* to fill the situation of surveyor of the navy. I sincerely wish he would recal those injurious expressions; for, even allowing, which I am not at all disposed to do, that Captain Symonds was competent to fill the situation, *yet it was not necessary to depreciate the talents and abilities of other persons*, who, I contend, are quite as qualified, nay, much more so; because the office requires a degree of practical knowledge, in putting together ships, which those gentlemen possess, but which Captain Symonds cannot possibly be acquainted with. The right hon. baronet has illustrated his argument of the fitness of Captain Symonds, notwithstanding his lack of practical skill, by saying that a civil engineer need not be a mason. I grant him thus much, that the surveyor of the navy may not be required to be able actually to put the planks of ships together, but he ought to have a sufficient knowledge to be able to say when those planks are or are not properly put toge-

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honourable principle, irreproachably just, and desirous only of acting in strict adherence to what he conceives to be for the best interests of the navy. But, as the right hon. baronet does not profess to speak from a personal knowledge of the merits of questions with which he, from the

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ther. The right hon. baronet, however, says that an experiment of Captain Symonds's fitness for the situation is about to be tried; but has not the right hon. baronet put the cart before the horse, by making the appointment before he has made the experiment? I really cannot consider the appointment of this gentleman as anything but a slur cast upon that body of individuals whom I know, from my own knowledge, to be competent to fill every situation in the navy.

Mr. HUNT.—Without pretending to know anything about ship-building, I cannot help thinking that the right hon. baronet is acting upon an entirely false theory in his appointments. He seems to lay it down as a rule that a person is quite competent to perform the duties of surveyor of the navy, without knowing how to put the pieces of a ship together. Now, I always understood that it was impossible for a man to be a good and efficient master, without being also a workman, and capable of setting his men to rights when they happened to be wrong. *I should like to know how Captain Symonds can superintend the building of a ship, unless he is competent to show the men how to correct the errors they may commit?*

Mr. WARBURTON.—I cannot help thinking that the right hon. baronet, the First Lord of the Admiralty, has been rather hardly dealt with. It is not difficult to find parallel instances, where persons superintend the construction of works who are not themselves required to have the knowledge of making the construction. Is an architect required to be a carpenter or a mason? It is certainly necessary, that he should be able to judge when the works are well put together, and that knowledge can only be learnt from experience, but it is not necessary that he should be able to plane the boards, and put them all together. But the First Lord of the Admiralty has explained that there are many other and superior duties to be performed by the surveyor of the navy, besides the duty of superintending the building of a ship. He is to look at the economy of labour, and the general management of the work; he is to see how a great number of labourers is to be employed with the least waste of labour. I can conceive a person not educated as a ship-builder, and *not having information upon the subject,* (!) but who yet shall be in every respect competent to discharge the duties of surveyor of the navy.

Mr. MAURICE O'CONNELL.—I also conceive that the First Lord of the Admiralty has been hardly dealt with. I do not think it is quite so necessary, that a naval officer, who from his infancy is familiar with every part of a ship, should be required to be acquainted with the mechanical operations of a ship, in order to qualify him to fill the situation of surveyor of the navy. I speak from some little experience: for though I have not served an apprenticeship to ship-building, yet I have acquired some little knowledge of the subject, which, I think, would enable me, after a very little practice, to detect any deficiency in the putting together the timbers of a ship; and if that degree of knowledge can be acquired in a short space of time, I think the right hon. baronet ought not to be so much blamed for the appointment he has made.

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nature of his office, is identified, he will, perhaps, pardon the intimation that in some important parts of his speech which are supposed to be statements of *facts*, he has been misguided; and that in the *opinions* by which he has been advised, respecting the practical and theoretical attainments in that department which has been pronounced to be inefficient, the truths which Experience and Science teach appear to have been overlooked.

With respect to the appointment of the new surveyor, Sir James Graham has certainly shown a disposition to judge for himself on that subject, having very fairly said, that he is perfectly ready to admit that the merits of that appointment have yet to be put to the test; and having told the House of Commons that there was a ship (*Vernon*) ready for sea, and that he was quite willing that the merits of the appointment should rest upon the fate of that experiment. When he made these remarks, neither the Admiralty nor the public had any other means of forming an opinion on Captain Symonds's talent, as a naval architect, than by some kind of experiment, for we were then wholly unacquainted with his principles of construction. But we are now very differently circumstanced, for Captain Symonds has since explained his principles; and it is the more fortunate that he has done so, because the opinions respecting the VERNON, have been so absurdly contradictory, that it is impossible to draw any conclusion from them which would not be denied by the partisans of separate interests.

Results, unaccompanied by a luminous exposition of the system or process by which they are produced, are at all times extremely unsatisfactory, in a philosophical sense. *Sir John Herschel* says, "The tendency of empirical art is to bury itself in technicalities, and to place its pride in particular short cuts and mysteries, known only to adepts; to surprise and astonish by *results*, but conceal *processes*. The character of science is the direct contrary. It delights to lay itself open to inquiry, and is not satisfied with its conclusions till it can make the road to them broad and beaten; and in its application it preserves the same character, its whole aim being to strip away all technical mysteries, to illuminate every dark recess, and to gain free access to all processes, with a view to improve them on rational principles."

Captain Symonds appears to entertain similar sentiments, for he has published a pamphlet in the *United Service Journal*, (No. XLIV. July 1832,) subsequently to the debates, which has put us in possession of the principles which brought him into office: he there courts the test of any examination or controversy, and appeals to the public to judge of the correctness of a system by which he pledges himself to stand or fall.*

* As I desire to have the full credit of my principle, if successful (as it is

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It has been remarked that, "there is nothing incompatible between esteem for the moral and even intellectual qualities of a person's mind, and a full conviction of the inaccuracy of his views and the unsoundness of his arguments: nothing inconsistent between respect for the one and a free exposure of the other."* Now this is precisely the feeling under which we shall approach Captain Symonds's pamphlet on naval construction; we admire his candour, but object to his doctrine; at the same time, we shall not merely assert the existence of errors, but endeavour to point out, upon philosophic principles, what those errors are.

It is now proposed to offer a few observations on the Ship-Building Department generally, arranging the subject under the following heads, or sections.—

By endeavouring to show that the duties which Sir James Graham enumerated, as being connected with the office of Surveyor of the Navy, ought to be better executed by a practical ship-builder than by a naval officer.

2. That the evil consequences of not having a surveyor of the navy conversant in practical ship-building have already been proved, by dearly-bought experience.

3. That the surveyors of the British Navy have not been found wanting in the qualifications required of them; but that if they have shown themselves to be deficient in the *science* of naval construction, "the blame must, in justice, fall upon Government, and not upon them.†"

4. That a school of naval architecture was formed with a view to improve the English method of Construction upon scientific principles, but that the department in which it was proposed to call in the aid of science has not been permitted to be modified by the institution, although a period of twenty-two years has elapsed since its first formation; and that the country cannot therefore judge of the advantages to be derived from an establishment like the School of Naval Architecture.

5. That the School of Naval Architecture is, at this very time, suffering under erroneous impressions which have been con-

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borrowed from no other source), so I am prepared to acknowledge my error if failure awaits me.—(*Captain Symonds on Construction.*)—*United Service Journal*, No. 44, page 346, line 21.

* Bailey's Essays on Truth.

† Report of Board of Inquiry.

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veyed to the First Lord of the Admiralty, and, through him, to the public, with respect to the *length of service* of its members, the *situations* they hold, the *number* of students unprovided for, and the nature of their *qualifications*. These are mere matters of FACT, which will be explained, and may easily be set at rest by documentary evidence.

6. That Captain Symonds' theory, as published in the United Service Journal for July 1832, is incompatible with the principles of science, and may be proved to be so by mathematical demonstration.

7. That the Naval Architectural Department are quite competent to explain, upon scientific principles, why *large* ships ought to possess advantages over smaller ones, and can show, from the records of experience, that those principles have been successfully acted upon from time to time; but as British men-of-war have hitherto been restricted to *tonnage*, according to the number of guns which a vessel is intended to carry, it has been erroneously inferred that English ship-builders were not aware of the advantages of increased dimensions, which will often more than compensate for superior skill in the construction of a smaller ship. The unprecedented *tonnage* now given to our ships, is not, therefore, the development of a new principle, but the application of an old one, in the adoption of which we are imitating the Americans, "the dimensions of whose ships are more than equal to our first-rates, although by them denominated seventy-fours and eighties."*

Lastly. That a candid inquiry into the present state of the theory and practice of ship-building, on which such very different views are entertained, appears to be most desirable, as tending to establish some fundamental principles in naval architecture, and thereby to perpetuate a correct system of construction.

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§ 1. We shall venture, first, to offer some comment on certain parts of Sir James Graham's Speech, in order to put him in possession of opinions which differ from those of the professional advisers by whom he has been influenced; prefacing our remarks with a few quotations

* Captain Symonds' pamphlet (page 353, line 41.—*United Service Journal*).

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from the prescribed duties of a Surveyor of the Navy, as described by the Board of Revision (1806).

"The senior surveyor, besides the ordinary duty of his office in the committee of correspondence, is to direct in preparing the *drawings* of ships and vessels ordered to be built for his Majesty's service, either in the King's or Merchants' yards, and to determine the dimensions and scantlings of their frames and masts and yards."—"To examine and approve all notes from the yards for *task* and *job*-work; to propose *prices* to be allowed to workmen not already established."—"To correspond with the officers of the yard respecting the propriety of estimates from the several dock-yards, for an explanation of such parts thereof as do not appear clearly stated, and to make such *alterations and additions* therein as may be necessary."—"To consider the *prices* proposed by the officers of the yards for all works performed by contractors upon valuation."—"To visit the several dock-yards, and to inspect the *building* and *repairs* of King's ships in Merchants' yards," &c. &c.

Here we perceive that the "application" of labour, the "economy" of labour, and the "adjustment of the whole scheme" of labour, are, as Sir James Graham observed, duties intimately connected with the office of Surveyor;* and we shall find that the Commissioners of Naval Revision particularized these points as being among the *most important* parts of the duties with which the Members of the School of Naval Architecture should become conversant. They say, "the superior class of apprentices are to be employed during a portion of their time in working with the shipwrights, in the building and repairing of ships, so as to add the practice of the art of ship-building to the study of the theory, and by those means to enable them to form the plans of our ships of war consistently with scientific principles, and render them, at the same time, competent to *judge of the labour* that must necessarily be bestowed on the execution of every part of a ship, the *wages*, that by proper exertion may be earned, and the *quality* of the work when completed. These we conceive to be amongst the *most important* parts of the duty which your Majesty has been pleased to commit to us."

The Commissioners of Naval Revision therefore, after a deliberate investigation and a minute inquiry into the subject, felt convinced that in order "to judge of the application and economy of the labour, and the whole scheme of labour," an individual should not only have been accustomed to watch the progress of labour through all its stages in the building and repairing of ships, but that he should actually have some experience in the use of tools. In fact, they explicitly say, that a knowledge of practical ship-building is indispensable. Hence, one of the qualifications which Sir James Graham named, as being, in his opinion, requisite

* *Vide* Sir James Graham's speech (page 6).

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for one of the immediate duties of a surveyor of the navy, happens to be a qualification which, instead of having been overlooked, was particularly noticed when the establishment of a School of Naval Architecture in this country was under the consideration of Government. Consequently, if it be upon this point that the First Lord of the Admiralty conceives that the new surveyor is more competent than any other gentleman he could select to fill that office, he must think that "the practice of the art of ship-building" does not qualify a person to judge of labour, of wages, and the quality of work. And it really seems that the First Lord has been so persuaded, because he observes, "I do not think that a surveyor of the navy is required to be a practical ship-builder."

Now, although Sir James Graham may have had the advantage of good advice, of high professional character, we have recorded opposite opinions, also of high professional authority, which ought, in justice, to be contrasted with that advice. The Commissioners of Naval Revision conceived that the practice of ship-building is essential to a knowledge of the application and economy of labour, and the whole scheme of labour. That opinion was acted upon by the king in council; and when opinions founded upon the results of a strict and impartial investigation instituted by the crown, have been made the ground-work of a public covenant, we submit that that covenant ought to be considered binding, until it is abrogated by an equally open and formal proceeding; or until it is unequivocally proved to have been conceived in error. We submit too, that such proof ought to emanate from a committee of the most talented men in the naval and scientific departments, armed with the same powers, actuated by the same principles, and conducting their investigations with the same patience and perseverance, as the Board of Naval Revision did. The School of Naval Architecture rests its claims upon the opinions of that Board, just in proportion to the confidence which they feel themselves bound to repose in the encouraging promises held out by the Government; and if the pledge of Government be not inviolable, in what does the stability of public institutions consist? The School of Naval Architecture consider therefore, that they are legally better qualified (and they apprehend they are actually so) for *this* duty of the naval architectural department, than a naval officer; and in thinking so, they cannot be said to detract from Captain Symonds's high professional character, nor flatter themselves upon their assumed superiority, considering the means they have had of judging of the "application and economy of labour, the discipline of the dock-yards, and the whole scheme of labour."

The next duty of a surveyor of the navy mentioned by the First Lord of the Admiralty in the course of the debates, refers to the superintend-

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ence of the practical department. I admit, said Sir James Graham, that "it is the duty of the surveyor to superintend the master shipwrights." But what kind of superintendence can we call that, which does not strictly signify the capability of directing, explaining, or pointing out, every duty connected with the office of master shipwright? Can we call that superintendence which merely consists in the authority to say to one, "Come, and he cometh; and to another, Go, and he goeth?" Or, does not superintendence imply the judgment to discriminate between the propriety of approving or condemning whatever relates to professional details? To be sure, Sir James Graham has so far conceded this point as to have said, that though Captain Symonds is to have the *control* of the master shipwrights, one of them (Mr. Lang) could be called upon to exercise part of that control for him.

Another point to which we would briefly advert is, that Sir James Graham should consider that a practical ship-builder is ineligible to the office of Surveyor of the Navy, merely because he has been a shipwright.* Admirals who have risen from before the mast, and General Officers who have been elevated from the ranks, are not, we believe, remarkable in history for having evinced that degree of fellow-feeling towards their subordinates, which has prevented a due enforcement of discipline: and it is admitted, by proverbs out of number, that an overseer who can tell from personal experience where irregularities are most likely to be met with, is the most fit person to detect abuses. If, however, the fear of too much fellow-feeling still be a difficulty in the opinion of the First Lord of the Admiralty, that objection does not apply to the School of Naval Architecture; for the early professional pursuits of its members no more resemble the habits of the operative mechanic, who earns his livelihood by handicraft, than the pursuits of young gentlemen who enter the navy under the expectation of rising progressively to the top of their profession, resemble the habits of a ship's company. But this is not the strongest light in which we view with sorrow the appointment of an unprofessional gentleman to the surveyorship. The greatest hardship, in our opinion, is the innovation on professional usage; unless, indeed, it were the commencement of a new system of providing an improved succession of naval architects.

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* *Sir James Graham's Speech.* But I must state my objection to place a shipwright in the situation of Surveyor of the Navy; that objection is, that a person who has himself been a shipwright, would necessarily have too close a connexion with the other shipwrights of the yard, to enable him to exercise that control over them which the public interests may make it requisite should be exercised; and wherever this salutary authority is relaxed, abuses and irregularities are always sure to be the consequence.

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In trades, and in the "liberal" professions also, it is necessary to go through certain forms to constitute eligibility to preferment. In the Ship-building department, for instance, a man would not be employed among other shipwrights even on daily labour, unless he could produce legal indentures to prove that he had regularly served his time to the trade. It is the same at the Universities, and it is so in the Navy: persons must keep their *term* to become eligible to promotion. And yet, the present surveyor has not only overcome the first difficulties, but actually steps over every other grade to fill at once the highest post of honour in a department not even his own! What would be the feeling throughout the navy, if the First Lord of the Admiralty were to tell the House of Commons that the Right Hon. Lord Yarborough, Commodore of the Royal Yacht Club, had been represented to him as an individual of eminent attainments in naval evolutions; that he is not only a great tactitian, but possesses a superior conception of the discipline of a ship's company; that having carried pieces of ordnance in his yacht, he was conversant both in the theory and the exercises of naval gunnery; and that, upon the whole, he thought him more competent than any other gentleman he could possibly select to hoist his flag on board a man-of-war, and take command of a British fleet? What, we ask, would be the feeling throughout that honourable profession which is at once the pride and boast of England, and of which *Captain Symonds* is so bright an ornament,* if such a sentiment were uttered?

It is deemed unnecessary to enter more fully into this part of the subject; trusting that enough has been said to show, that if it were considered desirable to select a surveyor of the navy who should be a practical shipwright, capable of directing the mechanical department of the dock-yards, also of judging of the application and economy of labour, and the discipline of the dock-yards, and the adjustment of the whole scheme of labour, Captain Symonds cannot be so competent as many other gentlemen to fill the office of surveyor. The question now is, whether there is any evidence on record to prove that a surveyor of the navy is required to be a practical shipwright. This brings us to the second division of the subject.

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§ 2. History is the argument of experience, and will of course have far more weight than the mere opinions of the writer, whose mind may be

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* *Sir George Cockburn's Speech.* I have the honour to know that gentleman (Captain Symonds), and there is not a better sailor in existence; but that is not a sufficient qualification for Surveyor of the Navy.

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suspected to be warped by interested motives; we shall therefore quote the evidence of tradition, to show the evil consequences in former times, of *not* having a surveyor of the navy conversant in practical ship-building.

In Pepy's "Memoirs touching the Royal Navy," which is rather a scarce little volume, there is an account of the ruinous condition into which the English navy deteriorated in 1684, and the deranged state of the British dock-yards, for want of a practical shipbuilder to superintend them. In 1679 when his then Royal Highness the Duke of York (afterwards James II.) was Lord High Admiral, he went abroad, leaving the duties of his office to be executed by the Lords Commissioners of the Admiralty. Mr. Pepys (who was previously Secretary of the Admiralty) was at that period confined to the Tower; and *Sir Anthony Deane*, formerly a practical shipwright, was holding the office of surveyor of the navy; but in 1680, he "industriously flung up the charge of Commissioner of the Navy, from his early prospect of its falling into that condition in which his Majesty afterwards found it, and out of which he was therefore pleased finally to insist upon Sir Anthony Deane's return to his assistance in the rescuing it."

The opinions and foresight of practical ship-builders are just as valuable in their way, as professional opinions in any other department; and we shall find that Sir Anthony Deane was far from being wrong in his prediction; for in the space of less than *five* years after he quitted office (1684), it was soon discovered, when the Duke of York returned home, that mismanagement and want of due attention to the inglorious duties of ship-carpentry, with its contingent business, had brought the navy into a shamefully neglected state. Accordingly, James and his Majesty King Charles II. set about ameliorating the condition of the British Fleet; but at the end of twelve months, after expending 90,000*l.* (an enormous sum in those days), they found they were making but little progress in their object. Mr. Pepys was a stranger all this time to what was going on. Being, as he says, "wholly sequestered from that and all other public affairs, those of the navy became foreign to him, as having no other notices concerning them than what too often occurred in public conversation, touching the effects of inexperience daily discovering themselves in the conduct of them, into whose hands the civil departments of the navy had fallen." However, in 1684, when James II. came to the throne, he sent for Mr. Pepys, and consulted him respecting the best method of extricating the professional branch of the civil department of the navy from the calamitous situation in which he had found it on his return from abroad. The counsel offered by Mr. Pepys was, to *recall* Sir Anthony Deane! His Majesty accordingly acted upon

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that advice, but Sir Anthony Deane "refused even to offence," so solicitous was he of not returning to office; and the ex-surveyor would have prevailed in his entreaty to be excused, had the king known where to find another individual equally practised in the art of ship-building. Mr. Pepys contended, and there are incontrovertible proofs to bear him out in his views, that the civil department of the navy should at least have *one* surveyor possessing "a practical knowledge in every part of the works and methods of your navy, both at the board, and in your *yards*, the not discerning of which appears to have cost your royal brother and you, within the fore-mentioned five years, above HALF-A-MILLION!!"

Sir Anthony Deane was originally a practical shipwright, and an eminent man in his profession. The same may be said of many of our late surveyors, who have distinguished themselves by their intelligence and professional skill, and were all as eminent in their time as Sir Anthony Deane was in his day. But they were all practical men.

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§ 3. When the Commissioners of Naval Revision described the characters and professional attainments of English ship-builders, they expressed themselves as follows—"We trust that nothing stated in our report will be understood to imply censure, or impute blame to those officers at present in this department. The impression made upon our minds in the course of our investigation, has not been of a kind to lead to any such intention. We have found among them men of strong natural parts, and of *great intelligence and professional skill*, considering the means of improvement afforded to them: we believe them to be in general good builders of ships, and, if they have but little knowledge of the Science or Theory of naval architecture, the blame must in justice fall upon Government, for not having formed any plan for their instruction, so as to furnish them with an opportunity of obtaining it." English ship-builders, from the nature of their ordinary pursuits, could not be expected to be *scientific*; but they can scarcely fail to be good practical shipwrights, for their professional habits are peculiarly calculated to qualify them as efficient superintendents of the operative departments. To deny this, would be contrary to our usual mode of reasoning on other matters; and the argument which applies to the fitness of a person to supervise one dock-yard, extends to the whole.

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§ 4. It seems almost needless to remark, that a School of Naval Architecture was not established in this country before it was much wanted, since it has freely been admitted that "every victory which reflects honour on our sailors conveys a stigma on English ship-builders." Every writer on

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naval science tells the same story; and all agree, not only that we cannot pride ourselves on genuine British models, but that models of foreign origin which have been held up as objects worthy of imitation, have often been ruined by unscientific attempts at alterations. French ships in particular have been singled out as possessing remarkably good qualities, and their superiority is invariably accounted for by the fact that the French are a scientific people, and that they apply their science to naval architecture. England, on the contrary, has not cultivated science, in connexion with ship-building.

Confident of victory, by former success—practised in seamanship—possessed of a numerous fleet, morally and physically superior to our enemy's—and expert as shipwrights, it has been our failing to believe that superiority in strength and the good cause of defending the sovereignty of the seas, were everything. But the Commissioners of Naval Revision, after a most laborious attention to the subject, pointed out the true situation in which the country stood, in 1806, and recommended a School of Naval Architecture as the only means of supplying a succession of naval architects, qualified, in a scientific sense, to meet the exigencies of the nation. The members of the Board of Revision could not have been actuated by any sinister motive: the expectation of individual patronage was completely out of the question. They formed their opinions deliberately, upon the results of a minute inquiry into the subject, and identified their names with their labours. They examined most respectable witnesses, and suggested what appeared to them, upon mature investigation, the only plan for uniting *theory* with *practice*; that is, the Science of naval construction with the Art of ship-building. But although the School of Naval Architecture has been instituted nearly twenty-two years, the department in which naval construction has always been attended to, has not undergone the proposed modification. Had some of the members of that institution applied their theoretical knowledge to available data, we must, ere this, have arrived at a very improved system of naval architecture: but without a department in which the principles of naval construction can be sedulously prosecuted, English ship-building must continue to be carried on with the same uncertainty and probability of failure by which it has hitherto been characterized.

It is in some measure satisfactory to the members of the School of Naval Architecture, to find that many individuals who have evinced an interest in the advancement of naval science, and who have had the means of judging of the necessary qualifications for a naval architect, have referred to that establishment as a source from which the nation may hereafter look for much benefit in the science of construction; but it has unhappily happened, that those liberal professions have rarely emanated

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from a quarter where the fostering protection of an influential patron could then assist in so desirable an object. The members of the School of Naval Architecture were admitted into the establishment by public examinations, which were conducted with strict impartiality. The candidates were always numerous, but the number of students admitted was invariably limited; and perhaps this is the only national institution in which merit without patronage could avail. This feature ought to be its strongest recommendation, but it has proved to be the reverse. The School of Naval Architecture has never had the good fortune to have a patron to bring it into notice; and having wanted that, it seems that it has wanted everything.

Among the numbers of writers who have declared their confidence in the advantages to be derived from the School of Naval Architecture, we must not omit to name *Captain Symonds*, who has prefaced his observations on naval construction in terms of which the following are a part. "It is devoutly to be hoped that the college, at present in its infancy, will, in future, promote the *neglected* science of naval architecture, and that the encouragement of premiums to students and others, producing the best and most approved models, will be offered by Government. Experiments in naval construction, on a large scale, would be found too expensive and ruinous, until the *science* in all its branches is better understood."

When Captain Symonds indited this passage, he, like many in the present day, might not have been aware that the members of the School of Naval Architecture take no part in the neglected science of naval construction, so long as they hold subordinate situations; nor is it likely he could have anticipated that an "infant" institution (a term no longer applicable) would be so completely lost sight of, that twenty-two years would elapse without any one of its members having at any time given even an opinion, in an official way, on the subject. Can the present Admiralty be aware of this? Can the public conceive it possible? Is it likely that the members of the House of Commons who hear the charge of professional incompetency imputed to the whole of the ship-building department, would suspect that not one of them has even prepared an original design (of his own) from which a ship was built; or been called upon candidly to show wherein the deficiency of the present system consists? We can assure the reader that the School of Naval Architecture has neither been heard, nor tried. Heard, perhaps, they have been; but whether they have been listened to, is another question. They have spoken through the press, by publishing a great deal of scientific matter in various forms, and by carrying on a series of "Papers on Naval Architecture, and other Subjects connected with Naval Science," for

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seven years.* The journal which they have conducted is known to have taken a very creditable stand among the scientific periodicals of the day; and they have thus made some return for the education they have received, and given some proof that public money has only been "unprofitably laid out" upon them, because they have never been permitted to assist in putting the English method of construction upon a scientific footing.

Persons unconnected with the service infer, especially at the present period, that failure of some kind has actually attended the plan on which the School of Naval Architecture was founded; they cannot comprehend what the institution can possibly effect, because they do not hear, after a reasonable lapse of time, what it has done. They conclude either that its members have failed to exert themselves, thereby forfeiting their original expectations; or, that if they have exerted themselves to advance naval science, it has been without success.

The grounds on which we set out forbid everything in the shape of conjecture, otherwise it might not be difficult to assume causes (we will not say reasons) why none of the new school have yet been called into action in the capacity of naval constructors; that is, attached to an office in which the principles of naval science might, for the first time, be cultivated. An exclusive principle has hitherto shut the door against the introduction of science into the naval architectural department; and it is to be feared that even the individuals now in power (the naval administration) have been biassed by opinions which would not bear scrutiny.

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§ 5. This last observation calls upon us to show in what respects the First Lord of the Admiralty has been misguided on points which are supposed to be mere statements of *facts*, and on which he will no doubt be sorry to find, that the mistake has invariably been to the disadvantage of those whom he has been persuaded are incompetent to fill the various grades in their own profession. It is not intended to imply that Sir James Graham has been *wilfully* misled; but it will be shown that even in the materials for a Parliamentary speech, *facts* have been overlooked.

Sir JAMES GRAHAM.—"*These gentlemen* (*the members of the School of Naval Architecture*) *have not been above* SIXTEEN *years in the service, seven years of which was, of course, during their apprentice-*

* *Whittaker*, half-yearly, 5s. 6d. This work, which was edited by Messrs. Morgan and Creuze, has been recently discontinued, without any alleged reason on the part of the conductors. It is supposed, however, that they saw the impossibility of carrying on such a publication without appearing to write in opposition to the new system of naval construction, which is irreconcilable with the principles on which the Papers on Naval Architecture were conducted.

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ship; therefore, they have not much reason to complain." * * * "*Are they not* ALL *holding situations under the Government?*"

Explanation.—The annexed table will show that the senior members of the School of Naval Architecture had been nearly *twenty-two* years in the service, in June 1832, instead of only "sixteen;" and Sir James Graham will now have an opportunity of acquainting himself with the additional fact, that so far from "all" the students holding situations, even the students of *seventeen years and a half standing* (!) were not all provided for, at the time of the debates. And when the First Lord of the Admiralty is reminded that the age of admission into the School of Naval Architecture is between 15 and 17, he will then perceive that at the time

Date of Entry.	Number of Students admitted.*	Term of Servitude on the 27th June, 1832.
1811	4	21 yrs. 6 mths.
1812	2	20 6
1813	3	19 6
1814	3	18 6
1815	4	17 6
1816	2	16 6
1819	2	13 6
1822	6	9 10

of the debates there was a student (admitted in 1815) to provide for, who could scarcely have been less than 33 years of age!

The circumstance of a student waiting ten years and six months after having completed his term of apprenticeship, making him nearly middle-aged before he fairly commences his professional career, must be allowed to be a source of disappointment; but it was never made a ground of complaint. The students certainly did, in one instance, take occasion to represent what they conceived to be a grievance, when delay in promotion was rendered a very serious consideration, in consequence of an order from the Admiralty directing that, in future, the time lost in waiting for an appointment, should be deducted from that portion of their

* These are the numbers at present in the service, who were admitted at the time expressed. No notice is taken of those who have since left it, or died. (See Papers relating to the School of Naval Architecture, Portsmouth. Published by order of the House of Commons, 16th April, 1833.)

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servitude which constitutes the amount of claim to superannuation. To carry this object into effect, the students were no longer to be paid the income which, by bond, they were entitled to, but were immediately placed on "day-pay." The position into which they were thus thrown, led to communications of an unpleasant nature between the Admiralty, the Navy Board, and themselves, which it would be unadvised to enter into in this place. Suffice it to say, the termination has left the impression that justice, at all events, may be expected of the First Lord of the Admiralty, when he has the opportunity of hearing both sides of a question; for, three students were immediately placed upon *salaries* with an advance of 20*l.* per annum, and provided with situations in which they found permanent employment. This arrangement still left *seven* unprovided for, at the time of the debates, viz. *one* of 1815; *one* of 1816; and *five* of 1822.

We next come to what the First Lord of the Admiralty said respecting those who really have been provided for.

Sir JAMES GRAHAM.—"*There are three of these gentlemen* MASTER-SHIPWRIGHTS (*one of them has lately died*), *and several others are acting as* ASSISTANTS."

Explanation.—There are three builders'-assistants only, made from the School of Naval Architecture, (one at Woolwich, one at Sheerness, and one at Pembroke-yard,) but Sir James Graham may easily learn that there is not a single Master-Shipwright in the service who has been selected from that establishment. The Master-Shipwright who died (Mr. Pollexfen) was certainly builder of a foreign yard, but though it would appear from his title, that he held office of higher rank than a builder's-assistant, yet he was not so far advanced in the service as an assistant at one of the home yards. He never was an assistant; he was only a foreman when sent abroad; but had he returned, he would then perhaps have been promoted to the situation of an assistant. The assistant now at Pembroke-yard, was also once a foreign master-shipwright; but he was a *foreman* for a considerable time after his return to England. These explanations will enable Sir James Graham to perceive that instead of the School of Naval Architecture having been a favoured institution, it has always been struggling against the absence of patronage, and very often against misrepresentation: and that the members of that Establishment are not such "youths" as he has been led to suppose.

The First Lord of the Admiralty must feel greatly annoyed, when he discovers the extent to which he has been kept in the dark on matters of *fact*; and there is not a stronger instance of truth having been withheld from him, than the proof he has given of the delusion he laboured under only a fortnight ago in the House of Commons. So recently as April 15, 1833, when the navy estimates were again under discussion, Sir James

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Graham observed that Captain Symonds combines in his own person the advantages of having had great nautical experience, besides possessing considerable theoretical knowledge of the principles of Ship-building, while the members of the School of Naval Architecture know no more of a ship's behaviour at sea, than what some of them may have picked up on a *trip to Margate, in a steamer!!*

If Sir James Graham has been thus informed, we envy not the responsibility of those who, presuming to offer counsel upon points on which they betray their ignorance, are bold enough so to mislead the First Lord of the Admiralty.

To make the plan of education at the School of Naval Architecture as comprehensive as possible, and in every sense *practical*, it was proposed by the Commissioners of Naval Revision to send the students to SEA. In the Third Report of the Board of Inquiry, Part III. art. 12, they say—

"As it would be of advantage to the most able shipwright to have some practical knowledge in the steering, sailing, trimming, and ballasting of ships, with other circumstances attending them, it is proposed that they shall pass the last year of their apprenticeship at sea, on board such of Your Majesty's ships, of different classes, as the Lords Commissioners of the Admiralty shall direct; that, under the observation of the captain, they shall employ themselves in making remarks on the motion and working of the ship in all her parts in bad weather, and in a high sea; the standing and straining of the masts and yards in all circumstances, the fixture of the standing blocks, and the proper leading of the ropes, &c. That they shall consult with the carpenter of the ship, in order to obtain from him all the information which his experience may enable him to communicate, and assiduously to attend to all matters connected with their profession, for the acquirement of knowledge, which they may in future apply to the benefit of Your Majesty's service. That they shall daily minute down all observations they may make on the several matters before adverted to, and all others connected with the building, equipping, repairing, ballasting, &c. of Your Majesty's ships, and shall prepare, and, upon their return from this service, transmit to the Lords Commissioners of the Admiralty, and also to the Navy Board, a Journal and Digest of their Remarks on the several particulars before mentioned," &c. &c.

Now this part of the proposed system of educating naval architects was so far deviated from, that the students did not go to sea during their apprenticeship, it having been found that they could not dispense with the last year of their course of studies; and it being further considered that after a little experience in the dock-yards, their minds, on becoming matured to business, would be the better qualified for making useful observations at sea. They were therefore afterwards sent to sea. They have been sent to the WEST INDIES, SOUTH AMERICA, the BAY OF BISCAY, &c. for the special purpose of acquiring correct notions of the general evolutions of a ship in the element for which she is destined. It is true

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that none of the new school have been sent to sea since the present surveyor has had the control of the Naval Architectural department, although some of them are only waiting for appointments, and might therefore be spared from the dock-yards for such an object. It is true also, that none of the students have been sent to sea since the present Admiralty came into office, notwithstanding the admitted advantages of nautical experience to a naval architect; but they certainly did go to sea under the orders of former Naval Administrations. They did not embark as nautical men, to learn how to *hand, reef, knot,* and *splice;* that is, to qualify themselves in the manual duties of a seaman. No: they went to sea as naval architects, with the professional feeling of ship-builders; and it must be allowed that with such feelings, an individual may obtain more experience in reference to Naval Architecture in a few months only, than many nautical men will learn on the same subject all their lives.

Mr. F. G. YOUNG, *who is a ship-builder,* told the First Lord of the Admiralty that he agreed with him in thinking it desirable that a Surveyor of the Navy should have some experience at sea, as well as a knowledge of Naval Architecture, but that the *latter* should be the basis of the qualification.

The view thus taken of the subject by Mr. Young, is exactly the principle upon which the School of Naval Architecture has been instituted. It was contemplated that the students should go to sea, and they have been sent accordingly: but the principles of naval science were to constitute the *basis* of their education, and that intention has been fully acted up to. And if confidence cannot now be placed in the Members of the School of Naval Architecture, it is attributable more to the confidence that has been *withheld* from them, than to any other cause.

About eight years since, rumour announced the probable discontinuance of that "expensive and useless" establishment, the School of Naval Architecture; and at the time of the last experimental squadron, (1826), report went so far as to intimate that if the *Tyne,* of 28 guns, constructed by the Surveyor of the Navy, excelled the *Sapphire,* of 28 guns, constructed by Dr. Inman (Professor of Mathematics at the Royal Naval College and School of Naval Architecture), that the inutility of the institution would thus be proved. A pretty *proof,* indeed! Feeling ran rather high on that occasion, and at one time it was currently reported that Captain Hayes, who built the *Challenger,* of 28 guns (also the *Champion* and *Wolf* corvettes), was very likely to be made Surveyor of the Navy, in case *his* ships turned out to be the best sailers. No one ever mentioned Captain Symonds; but Captain Hayes was named, and the rumour was qualified by the remark that he was formerly a shipwright,

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having actually served an apprenticeship in one of the royal dock-yards, and being able to draw a draft. It would be digressing from the subject of this article to speak of the peculiarities of Captain Hayes's ships, or to speculate on the merits of the method by which he or any other individual delineates the form of body which, according to his judgment, is best suited for the purposes of a man-of-war; but this we must say, that if it had been known that a naval officer would ever be chosen to fill the most responsible office in the ship-building department, we should have guessed it to be Captain Hayes, for the reason above stated.

On so important a question as a variety of opinions on the theory of ship-building, one would naturally suppose that some attempt would have been made to ascertain on what points projectors in Construction differed. If naval architecture be a *science*, and if the laws of nature be not more capricious in their influence on ships than on other floating bodies, it is absurd to say that no clear distinction can be drawn between mere opinions and the absolute principles of science. But like rivals, playing the game of chance for the surveyorship—rather than like impartial promoters of the truth,—we find, the Official Department of the service, a Professor of Mathematics, and two Captains in the Navy, entering the field of competition; and we do not hear that their drawings were produced, the tendency of their properties analysed, the general views of the constructors compared, their specific objects stated, or even first principles admitted! A temporary superiority in *sailing* seemed to be the desideratum, and on this point the whole question absolutely appears to have turned.

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§ 6. Secrecy in matters of science, generally attaches suspicion to the motives of individuals; it looks like a wish to deceive by false means. But they who, instead of shrinking from inquiry, publicly court investigation, compel us at least to think favourably of their intentions; and though their speculations are not on that account shielded from scrutiny, they ought, nevertheless, to be met with all the courtesy which is consistent with the pursuit of truth. Captain Symonds has certainly done all that he could do; he has put us in possession of the sum of his knowledge, and has told us that he desires to have full credit for his principle, if successful (as it is borrowed from no other source), and that he is prepared to acknowledge his error if failure await him. He also says that his queries and remarks on naval construction ought, from their close connexion with the vital interests of Great Britain, to create some attention; and that they deserve, at least, a fair, impartial, and unprejudiced consideration.

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Let us proceed, then, to an impartial examination of Captain Symonds's principles (see United Service Journal, July 1st, 1832:—

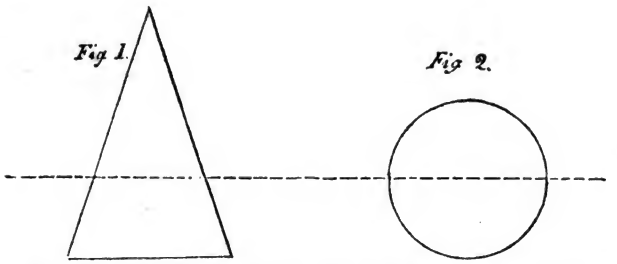
Principle I.

(Captain Symonds's Theory.)

"Q. Is a flat floor, or any other full feature in a vessel's body, to be termed *bearing*, when a sufficient weight has been produced to immerse it?"

"*A.* Nothing under water can be considered bearing, because any additional weight applied after it is immersed, would be the means of *sinking* it; try a full cask, a full tub, or anything having flat or round substruction, provided that there is no expansion or protrusion above the water's edge."—*U. S. Journal*, p. 351, line 27.

The sense in which bearing is here introduced evidently refers to the additional immersion caused by applying additional weight. "Try anything," says Captain Symonds, "having flat or round substruction, provided that there is no *expansion* or *protrusion* above the water's edge." He, therefore, forms his bodies under the impression that if a floating body have no expansion above the water's surface, any additional weight after the "flat floor," or any other "full feature" is immersed, would *sink* it.



Let *fig.* 1 represent the section of a cone floating with its vertex upwards.—

Here we have a "flat floor" immersed; and are we to suppose that any additional weight will *sink* that cone? That is, that it would actually *slip* under water by any additional weight, for no other reason than because its "full feature" is immersed, and that there is no expansion or protrusion above the water's edge? Or, if a sphere, *fig.* 2, be of half the specific gravity of water, and therefore only *half* immersed, are we to imagine that because that every part of the lower half "expands or protrudes" from the lowest point to the line of floatation, while every part

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of the upper hemisphere inclines the *reverse* way, that the former possesses "bearings" which the latter does not? If this be true, what we have hitherto considered to be the LAWS OF HYDROSTATICS are utterly false, the first principles of Hydrostatics being as follows:—

1. That if a body be, bulk for bulk, lighter than water, it will float in water.

2. That the *volume* of water displaced is equal in weight to the weight of the floating body.

Now it is evident, that the volume of water displaced by the upper hemisphere is equal to the volume displaced by the lower hemisphere; consequently, the same weight is necessary to immerse the upper half as the lower, without reference to the position of the "full feature." It must therefore be confessed that the opinions here put forth by Captain Symonds are completely at variance with the received principles of Hydrostatics.

Principle II.

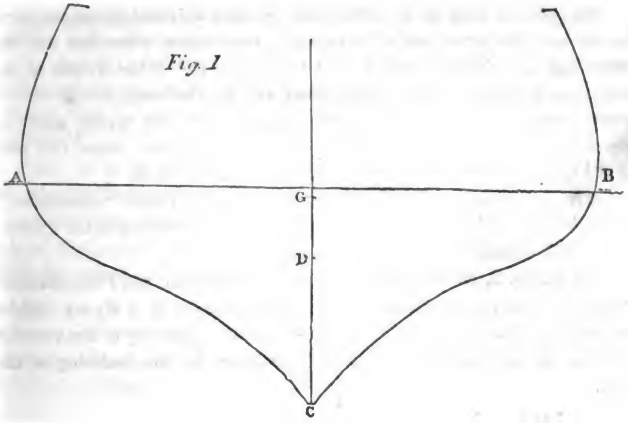
(Captain Symonds's Theory.)

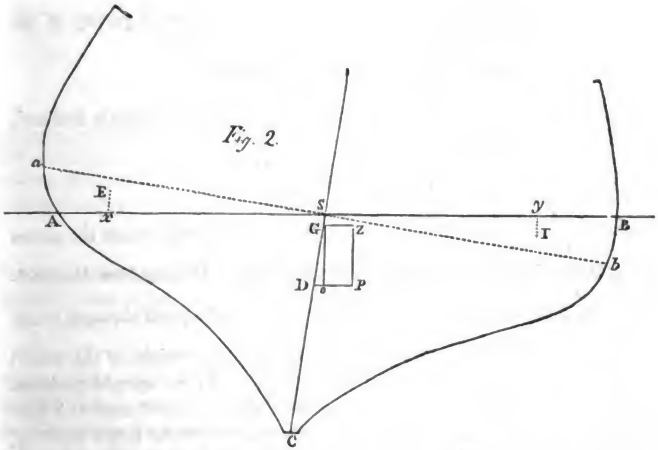
"Q. What may be termed '*bearing*' in naval construction?"

"A. 'Bearing' is that feature in a vessel's form which protrudes or swells the body to any extent longer or wider than that which the body possesses at the line of floatation, and being *above* the water's edge, sustains her when pressed by the wind, and when embarrassed by shipping a sea."—*U. S. Journal*, p. 351, line 22.

The best way of answering this query will be, by explaining the usual method of estimating a ship's *Stability*, or the power by which she is sustained when pressed by the wind. It is a theorem by Attwood, published in the *Philosophical Transactions of the Royal Society*, 1798; and we should suppose that the nature of the scrutiny to which papers are submitted, before they are recorded as the transactions of that learned body, will induce the reader to peruse Attwood's theorem with care, and compare it with the very different opinions which Captain Symonds entertains on the same subject.

Attwood observes, however, that "the practice of Naval Architecture guided in most parts of the world, by a species of theory, or systematic rule which individuals form to themselves from experience & observation alone ..... by repeated observation on the dimensions, proportions, and equipment of ships, & by attention to their excellencies & defects when afloat at sea, faults are remedied, good qualities are improved, & rules of practice are by degrees established





Let *A C B*, *fig.* 1, represent the mid-section of a ship when upright, the water's surface coinciding with *A B*. Suppose *G* to be the centre of gravity of the ship, and *D* the centre of gravity of displacement. By the principles of hydrostatics, *D* and *G* will be in the same vertical line.

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Suppose the ship to be acted upon by some external force, so as to be inclined to a given angle, as in *fig.* 2, the original water-line $a\,b$ intersecting the inclined water-line in some point S. If the weight of the ship remain unaltered, the displacement will be the same in both cases; consequently, the area $A\,S\,a$, which comes out of the water, must be equal to the area $B\,S\,b$, which is forced under water, since the part $A\,S\,b\,C$ is common to the two areas $a\,C\,b$ and $A\,C\,B$.

$A\,S\,a$ is technically called the "emersion," and $B\,S\,b$ the "immersion;" and being *equal*, they are represented by the same notation in the expression which denotes the stability of a ship.

Let E, *fig.* 2, be the centre of gravity of emersion, and I the centre of gravity of immersion. Draw $E\,x$, $I\,y$, perpendicular to $A\,B$; $x\,y$ will be the horizontal distance through which the centre of gravity of the variable part of the displacement has been transferred by the inclining of the ship.

Let b = horizontal distance $x\,y$.
A = immersion (or emersion).
V = displacement (or entire volume of water displaced).
d = distance ($D\,G$) between the centre of gravity of the ship and that of the displacement.
s = sine of the angle of inclination.

To find the centre of gravity of displacement when the ship is inclined, we use the following proportion:—

$$V : A :: b : \frac{b\,A}{V}$$

Then is $\frac{b\,A}{V}$ the value of the horizontal distance through which the centre of gravity of displacement has been transferred. Hence, draw $D\,p$ horizontally and make it equal to $\frac{b\,A}{V}$; p will be the point through which the whole effect of the buoyancy (equal to the entire weight of the vessel) will act in a vertical line, to restore the ship to an upright position. Draw $G\,z$ horizontally, meeting the vertical line $p\,z$; and draw $G\,o$ perpendicular to $D\,p$. $G\,z$ is called the "*measure*" of the ship's stability, because it is the distance at which the mean effect of the displacement acts to restore the ship to an upright position, by turning round an imaginary axis passing through the centre of gravity G.

Consequently, $G\,z \times V$ = moment of stability.
Now, $D\,o$ = sine of inclination to radius $D\,G$ ($= d$).
Therefore, $D\,o = d\,s$.

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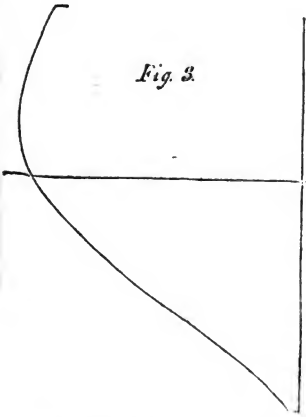
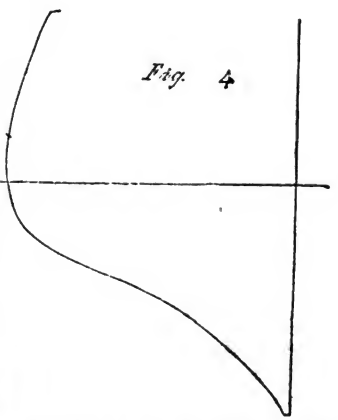
Consequently, $G z = D p - D o = \frac{b A}{V} - d s$;

and $G z \times V = b A - d s V$* which is the correct expression for the movement of stability.

If d, s, and V, be constant quantities, the movement of stability will vary as $b A$.

Now, A is the quantity immersed or emerged at a given inclination, and b is the horizontal distance through which the centre of gravity of immersion is transferred: hence we perceive that the form and magnitude of that part of the body of the vessel which comes *out* of the water affects the stability of a ship as well as that part which is immersed.





Figures 3 and 4 are midship sections having the same extreme breadth, and equal areas below water. *Fig.* 3 has a distinct feature of

* If the vessel's inclination be indefinitely small, the angle $A S a$ will become evanescent; that is, the area $A S a$ may be considered as a triangle, and the angle $a A S$ a right angle. Now, $S x$, which is equal to $\frac{2}{3} S A$, varies as $S A$; hence, $x y$ varies as twice $S A$, or as the *breadth* of the ship. And the area $A S a$, which varies as $S A^2$, varies as $\overline{breadth}^2$. Consequently, $b A$ (in the expression for stability) varies as $\overline{breadth}^3$: and, taking the length of the vessel into consideration, the stability will vary as *length* $\times$ $\overline{breadth}^3$. The negative part of the expression, viz., $d s V$, vanishes, since s becomes evanescent. Therefore, in comparing the stabilities of ships at evanescent angles, we say that they vary as the *fourth* power of their Breadth, provided the proportion of length to breadth be the same in all cases. This principle will be applied hereafter, page 38.

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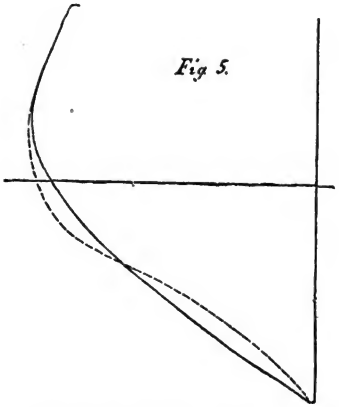
protrusion; *fig.* 4 does not get rid of the extreme breadth so suddenly as *fig.* 3, but preserves a more general fulness in the vicinity of the water-line.

The difference of form between *figs.* 3 and 4, may be clearly seen by inspecting *fig.* 5; in which the black line represents *fig.* 3, and the ticked line *fig.* 4.

Fig 5.



According to the general expression in the theorem, the stability of *fig.* 4 will be greater than the stability of *fig.* 3, at a given angle of inclination (if *d* remain the same), because both *b* and *A* will be greater in the former than in the latter case.

If Attwood's theory be correct, Captain Symonds' principle of "*protrusion*" must therefore be a fallacy.

Principle III.

(Captain Symonds's Theory.)

"Q. Which form will float most erect and steadily without being in danger of oversetting when the cargo is removed, and with only a small degree of ballast?"

"*A.* The broad sharp form; because that with a flat floor would have no *hold* of the water, and might easily fall on its side." (P. 352, line 38, U. S. J.)

The principle of this question may be thus exemplified. A body specifically lighter than water has a tendency to *rise*, in the same manner that a body in air, specifically heavier than the atmosphere, has a tend-

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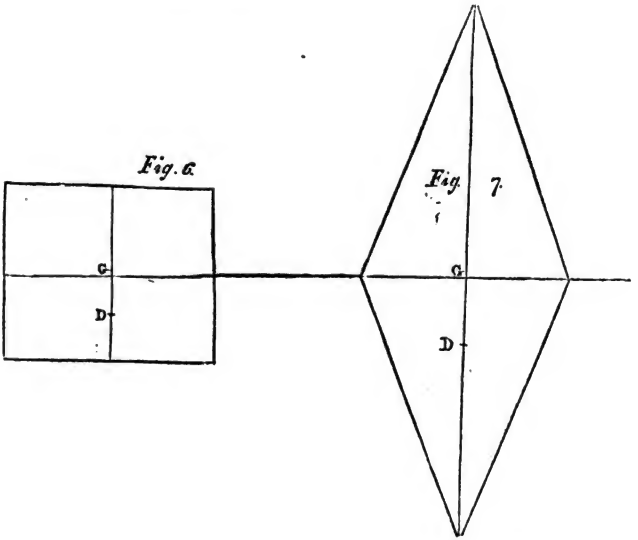
ency to *descend*. It might just as well be said, therefore, that the stability of a body on shore (a column for instance) is increased from being high, because it has a "hold" of the *air*, as assert that the stability of a floating body (every particle of the immersed part of which has a tendency to rise) is increased from being deep, because it has a "hold" of the water. The two cases are analogous, differing only in *degree*.



If a cylinder and double cone of equal contents (*fig.* 6 and 7) be each half immersed (their sectional areas at the water's surface being equal), the cone will, from the properties of the figure, be *three times* as deep as the cylinder; but at a given angle of inclination, the stability of the cylinder will be greater than the stability of the cone, because the *positive* part of the expression in the general theorem will be greater in the case of the cylinder, while the *negative* part of the expression will be greater for the cone (since the centre of gravity of the body remains unaltered, while the centre of gravity of displacement is lowered); that is, in the expression $b\,A - d\,s\,V$, both b and A are greater in the case of the cylinder, but d is greater in the case of the cone. And yet the cone has three times as much "hold" of the water as the cylinder.

If an EXPERIMENT would be more satisfactory, take an empty cask, and

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fasten a piece of plank, like a keel, edgewise along the lower part of the builge, the plank being specifically lighter than water; the effect of that increased depth would be to *turn* the cask, instead of "holding" it in its original position. In other words, it would destroy the stability. Again; a piece of plank (say ten inches wide and two inches thick) would float flatwise with considerable power of stability, but if that plank were to be gradually increased in thickness until its depth actually exceeded its breadth, it would suddenly turn upon its side, thereby showing that depth does not impart the property of holding the water.

Principle IV.

(Captain Symonds's Theory.)

"Q. Where ought the feature of bearing or swell on a vessel's exterior to exist, which constitutes real bearing?

"*A.* It is presumed from 6 inches to 3 feet (according to the size of the vessel) above the line of floatation, in a man-of-war when fitted for six months, in a merchant vessel when deeply laden."—*United Service Journal*, page 351, line 33.

The fact is, we have no such term as "*bearing*" in the science of naval construction; but so long as we understand each other, there is no occasion to dispute about words.

We have already shown that the form *below* water within the limits of inclination, has just as much to do with sustaining the ship when pressed by the wind, as the form *above* water. If Captain Symonds can show that we are in error, of course he will do so, because in proving us to be wrong, he will prove himself to be right. The idea of first *presuming* where the protrusion should be, and then saying, upon presumptive grounds, that the bearing, or swell, should be within the latitude of from 6 inches to 3 feet, is altogether so un-mathematical, that we are by no means inclined to place any confidence in the unsupported assertion of a journalist* who has recently affirmed that Captain Symonds is a "thorough mathematician, and a good algebraist."

The question which aims at a definition between bearing and *real* bearing, appears to be a distinction without a difference. If any feature of a vessel really be a feature of bearing, how can it be otherwise than a feature of "real" bearing? Surely, Captain Symonds cannot mean to say that there are real bearings and imaginary bearings!

It would impose a tedious task on the reader, to take him through the whole series of Queries and Answers contained in Captain Symonds'

* Metropolitan Magazine, No. XV. *Naval Architecture.*

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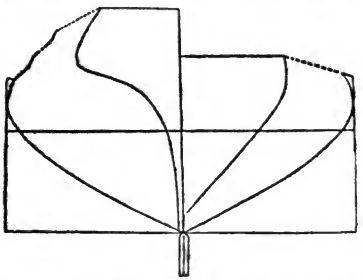
pamphlet on Naval Construction; moreover, it is quite unnecessary to do so, since the laws of Hydrostatics and the theory of the stability of floating bodies, are the fundamental principles in naval architecture; and it must be obvious that if Captain Symonds be wrong in first principles, he cannot be right in practices which are founded upon those principles.

Sir James Graham informed the House of Commons, that it was in consequence of very strong representations made to him, that he selected Captain Symonds to fill the office of Surveyor, for he was "perfectly unknown to him, except in his profession." And Lord Vernon has written a pamphlet respecting the Columbine, in which his lordship states that *he* was accessary in bringing forward the present mode of ship-building, assigning as a reason for doing so, that Captain Symonds "has brought to light some *new* and *distinct* features of improvement in naval architecture, no traces of which are discernible in the three experimental ships, viz.:—Orestes, Pylades, and Champion."

It is not worth while to lay much stress upon whether the features observable in Captain Symonds' ships, are *novel*, or not. Our principal inquiry should be—"Are those principles *true*?"

Many persons have remarked that the ships constructed by Captain Symonds are nearly a fac-simile of Greek vessels, of the polacca-rig, built at the island of *Hydra*; and, that the sails of these vessels have *straight leeches*, which is likewise a part of Captain Symonds' system. Vessels built at Ragusa, are also said to be very similar to Captain Symonds' ships.

But instead of relying on hearsay, we have ourselves traced a very close resemblance between the distinct features discernible in the *Columbine* and the form of a New York schooner-rigged pilot-boat, published in a Treatise on Steam Navigation, by a French author.* The following is the form of her midship section, also her bow and quarter sections.



* Mémoire sur les Bateaux à Vapeur des États Unis de l'Amerique, &c., par

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The *distinctness* of the features in Captain Symonds' ships, is discernible enough. That distinctness consists, first, in their having a protrúsion or swell, at a distance of from 6 inches to 36 inches above the water's edge, to constitute what the inventor of the system calls real bearing, or the property of making a vessel "staunch" under canvass. Secondly, an unusual tumbling home, or *falling-in*, of the topsides, so that the lee guns may be "water-borne," is another distinct feature. This tumbling-home, or narrowing of the topsides, extends quite forward, contracting the bows, aloft, more than ships in general. Thirdly, another distinct feature in Captain Symonds' system, is a remarkably lean after body, causing more flatness in the "buttocks" than has been approved by former builders.

If these distinct features be all rigidly preserved, then may the controversy and competition between Captain Symonds and Government ship-builders be made a fair one, provided all parties build under similar limitations of principal dimensions; but if it should hereafter appear (or if it could at present be made to appear) that the "protrusion," or "real bearing," is less distinct in vessels of later date than it was in the *Sylvia* cutter, and *Columbine* Sloop, and that it is still less distinct in larger ships, subsequently ordered to be built: if it should also appear at any future time, that the *after-sections* of ships of later construction are *less fine* than those of earlier date, and, moreover, that the very narrow Bows aloft, from the forecastle to the stem, have been *thrown out*, then will the "distinct features which were not discernible in either of the three experimental ships, Champion, Orestes, and Pylades," have worked their own condemnation, even to the conviction of those who reject every other than ocular demonstration.

Should the naval administration so far adopt Captain Symonds' recommendation, as to resolve that subjects which so vitally affect the best interests of Great Britain, "shall have, at least, *a fair, impartial* and *unprejudiced* consideration," then would particulars of this kind be diligently looked into; but after all, we should much rather argue from the principles of naval philosophy, than from a few incidents which would merely go to prove the instability of individual opinion. The principles of Science are by far the best test: besides, we then meet Captain Symonds on what is deemed to be his strong point, since his preferment to the office of Surveyor of the Navy, was mainly with a view to take the direction of the *scientific* department, in consequence of his being sup-

M. Marestier, 1824. The proportion of length to breadth, in the above boat, is 3½ to 1 very nearly; or, as 3.367 : 1. Here we have rather more breadth in proportion to length than in the *Vernon*. (See page 42.)

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posed to possess "considerable theoretical knowledge of the principles of Naval Architecture."

We know very well that Captain Symonds' control over the PRACTICAL branch of ship-building is to a certain extent only nominal, Sir James Graham having said that "*Mr. Lang, the shipwright, could superintend the mechanical part*" of the duties of the surveyor. His control over the DRAFTSMEN employed under him, may also be regarded as in some measure nominal, if Sir George Cockburn were borne out in saying, "*I believe he is not in the practice of drawing the plan of a ship. I know that when first he came to the Admiralty, he was obliged to have assistance in that respect.*" And the CALCULATIONS which are required to be made in preparing a draft, cannot, in reality, be directed by Captain Symonds, if what Sir Byam Martin stated be correct. "*The very ship he is now employed to build* (said the ex-comptroller) *he was unable to make the necessary calculation for; and he actually sent to the Navy Board to ask them to make the calculation, so utterly incapable was he of doing it himself.*"

These are not exaggerated statements, which we have gone out of the way to look for; but they are arguments adduced by every one, in common conversation. They bring the question within the very narrow compass of simply looking into the truth of the novel *Principles I. II.* and *III.* expounded pp. 27—34. If they be true, we are bound to acknowledge that, as far as relates to the scientific department, the appointment of Captain Symonds has been most wisely made, and that the promulgation of those principles is most desirable; but if, as we believe, they are untenable, then is the mischief likely to result from their adoption incalculable.

To the extent to which we have gone, we believe we have met this subject fairly and free from personality: at all events, it has been our studious wish to do so. If we have objected to Captain Symonds' views of naval construction, we have not done so in the *aggregate*, but principle by principle, as we have spoken of them; and then, not without giving reasons in each case for dissenting from him. If he be anxious to obtain full credit for a correct system of naval architecture, how infinitely more important is it, that they who have been regularly trained to an official plan of education, should be justly estimated by the public! We we are bound therefore to accept his invitation to controversy; not for the sake of malevolent criticism, but in self-defence, to encounter him openly in the field of naval science; to show that the principles which have placed him at the head of the professional department, are not the principles recognised by the profession itself; and to appeal, as he has done, to that searching tribunal the public, to protect TRUTH!!

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We shall close the subject with a few remarks of a more general character.

§ 7. Skill in naval construction, as in every other scientific art, consists in making the best use of limited means; that is, in imparting the greatest numbers of good qualities to a ship when restricted to dimensions. *Velocity—Stability—Stowage—Strength—easy Evolutions—and Economy*, must all be attended to in meditating an original design, the constructor having previously determined on the principal dimensions of his ship.

In speaking of the size of a ship, it is not customary in common parlance, to specify her length and breadth; but it is generally said that she is a vessel of a certain "tonnage," tonnage being the result of a rule which was once supposed to convey a correct idea of a vessel's magnitude or burden. Of the rule for tonnage we have only to remark, that it must evidently be a very incorrect method of estimating a ship's capacity, since the process is precisely the same for every conceivable form, being indiscriminately applied to a man-of-war, a merchant ship, or a yacht! We therefore agree with Captain Symonds in thinking that the rule for tonnage is a very absurd formula, and that if it be deemed necessary to confine a naval architect to any particular limitations in building ships, those limitations ought to be founded on some better principle than the imperfect mode of casting ships' tonnage.

Large ships possess many advantages over smaller ones. Theory teaches us that increased dimensions ought to improve ships' sailing qualities, and experience fully confirms the principle. It is desirable to dwell a little upon these points, because it has been said that "the Government ship-building department had no conception of the advantages of building frigates as large as the Vernon, or of the advantages of *Beam*," until Captain Symonds brought his principles into operation.

With respect to large ships, it may first be remarked that if two or more vessels be similarly formed, rigged, and stowed, the largest ought to sail better than the next in size, and so on downwards. This is explained by showing that the Area of the Sails, or the plane of *propulsion*, increases in a greater ratio than the midship section of the vessel, or plane of *resistance*.

Stability $\propto L B^3 \propto B^4$ (*page* 31, *note*).

Moment of sail $\propto$ *area of sail* $\times$ *height of centre of effort*.

$\therefore$ *moment of sail* $\propto$ *area of sail* $\times \sqrt{area} \propto \text{area.}^{\frac{3}{2}}$

Now, moment of sail $\propto$ *stability*.

Consequently, $\overline{\text{area}}^{\frac{3}{2}} \propto B^4$

or area $\propto B^{\frac{8}{3}} \propto$ the plane of propulsion.

But the *mid. section* or plane of resistance $\propto B^2$

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Hence the propelling power increases in a *greater ratio* than the resistance, which gives an advantage in point of sailing to the larger vessel. The larger vessel has also an advantage arising from its momentum being less easily overcome, or its progressive motion less affected, by the shock of a wave and the general agitation of the sea. If *Vernon* beat the *Donegal*, *Snake* the *Vernon*, and *Water-witch* the whole of the squadron (which was said to have been the case when these ships sailed in company in September, 1832),* such a fact would not at all invalidate the principle of the foregoing argument; because no two of them possessed that similarity which constitutes the necessary condition of a scientific experiment.

We have said that when one ship has the advantage of another in size, she is enabled to carry a *proportionate increase* of weight, and yet sail better than a smaller vessel. Consequently if no extra weight be added, not even a *proportionate* increase, a vessel is rendered so much the more powerful in relation to what she has to carry. Overloaded vessels, for this reason, must always be dull sailers.

To give a practical illustration of this principle, let us suppose a *seventy-eight*-gun-ship (the Donegal,† for instance, of 1901 tons) having two gun-decks, a quarter-deck and forecastle, capable of carrying a determinate quantity of canvass. Such a vessel would require a complement of 700 men, and suitable stowage for water, provisions, &c. Let us next suppose another ship of at least as large principal dimensions as the seventy-eight-gun-ship, with only one gun-deck, a quarter-deck, and forecastle. She will become a frigate, and, like the Vernon of 2082 tons, her armament may be estimated at 50 guns, with a complement of men amounting to 450 only. Now this ship may be made to preserve precisely the same draught of water as the seventy-eight-gun-ship, by reducing, or paring off, the fulness of her bottom, until the magnitude of the immersed body is reduced in proportion to their relative displacements.

The alterations thus effected will cause the immersed body to be considerably *smaller*, which may therefore be more finely formed than that of the seventy-eight-gun-ship; consequently the frigate will be more easily forced through the water by a given quantity of sail than the line-

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* See *Nautical Magazine*, No. X., page 490. The superiority of the *Water-witch* is certified by Lord Belfast, also by Sir John Pechell, one of the Lords of the Admiralty.

† The Donegal is mentioned merely because she was one of the ships in the late experimental squadron, against which the Vernon sailed, when Vernon, of course, had the advantage.

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of-battle ship. She will also carry the same quantity of sail as the seventy-eight-gun-ship with comparatively greater ease, because she has got rid of a great portion of top-hamper (by the removal of an entire gun-deck), and because the whole of the canvass may be brought bodily lower down than before. Hence, as far as direct progressive motion is concerned, the frigate ought to be the faster ship.

But she ought also to be a more *weatherly* ship; for, as the frigate will have less hull above water exposed to the action of the wind, she will be less operated upon by a force which has no other effect upon her than to increase her leewardly propensities; and having the same lateral resistance as the seventy-eight-gun-ship but less direct resistance, she will of course make less leeway in a given distance. Hence, with the same quantity of sail as a line-of-battle ship, it is not difficult to perceive that a frigate having the same principal dimensions as the line-of-battle ship, ought to possess a decided superiority in sailing by being both *faster* and *more weatherly*.

These are *our* principles; these are the principles of the Profession; they are necessarily the principles of every one who considers the science of naval architecture with a little attention: and we shall find, by taking a review of the history of fifty-gun-ships since the year 1706, that the greater the dimensions of a ship in proportion to the weight she has to carry, so much the better she will sail.

The history of this very class of vessels (fifty-gun-ships) proves that the advantages of large principal dimensions were well understood a century and a quarter ago, when naval science was but little known; and that the principle has been constantly acted upon. It will be seen by the Table, page 42, that in 1706, the tonnage of fifty-gun-ships was 704 tons; they were then 130 feet long on the gun-deck and 35 feet broad, and threw a round of shot equivalent to 630 pounds. In the course of thirteen years, this class of ships was increased fifty-one tons; fourteen years afterwards, they were again increased as much as 98 tons; and in the space of eight years more, they were made 115 tons larger than at any former period; still, however, carrying the same weight of shot as before, 630 lbs.

By this time, it was considered that the dimensions of fifty-gun-ships had been so much augmented, viz.—from 704 to 968 tons, that *heavier metal* might safely be placed on board them; and we accordingly find that it was recommended to arm this class of vessels with a more powerful battery, and that a round of shot was proposed to be equivalent to 828 pounds. The proposition of the *Lords Commissioners of the Admiralty* for the establishment of ordnance, 1743, runs as follows:—"Since the year 1733, but especially since the 1st of January, 1740, the dimensions

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of ships of your Majesty's navy have been much increased. We do therefore humbly propose that the number and nature of guns directed by your Majesty's order in council of 31st Jan. 1733, may be established in such ships of your royal navy as have been ordered to be built or rebuilt since 1st Jan. 1740, or shall hereafter be built or rebuilt, with this exception, that whereas the ships of fifty guns are now built of such *large* dimensions that they can conveniently carry twenty-two guns of twenty-four pounds upon the lower-deck, and as many twelve-pounders upon the quarter-deck, and two guns of six-pounders upon the forecastle, the same may be established upon them instead of those proposed in the year 1733."

Where situated.	Armament of 1733.			Proposed Armament of 1743.		
	No. of Guns.	Nature of Guns.	Weight of Shot in lbs.	No. of Guns.	Nature of Guns.	Weight of Shot in lbs.
Lower-deck	22	18-Pdr.	396	22	24-Pdr.	528
Upper-deck	22	9	198	22	12	264
Quarter-deck ..	4	6	24	2	6	24
Forecastle.....	2	6	12	4	6	12
Round of Shot..			630			828

The above proposition was acceded to, but the short experience of *two years* taught the impropriety of the measure; to remedy which, fifty-gun-ships were again increased and made eighty-four tons larger than ever. It is no new thing therefore, to build ships with increased dimensions, to make them more efficient.

In Derrick's Memoirs of the Rise and Progress of the Royal Navy, he says, "it may not be improper to mention that all the successes of the English against the Dutch in 1653 are ascribed chiefly to the superior *size* of our ships; an advantage which all the skill and bravery of the Dutch could not compensate!!" And JAMES, the naval historian, who was no naval architect, ridicules the idea of our having built the Larne, Hind, Spey, &c. upon the *reduced* lines of the Bonne Citoyenne. These, he says, are instances, in which Science has been obliged to bow her head before the pen of authority.

If the true characters of ships which have from time to time composed the British navy had been scientifically registered, we should have been

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much better informed on the principles of naval architecture than we now are; but it would be preposterous to tax the ship-building department with being so ignorant as not to know that enlarged dimensions are peculiarly favourable to the reputation of a constructor, the following Table being a proof to the contrary.

An account of fifty gun-ships, with their increased tonnage, from time to time; also the weight of a round of shot.

Date.	Tonnage.	Weight of Round of Shot in Pounds.	Length on Gun Deck.		Extreme Breadth.	
			ft.	in.	ft.	in.
1706	704	630	130	0	35	0
1719	755	630	134	0	36	0
1733	853	630	134	0	38	6
1741	968	630	140	0	40	0
1743	968	828	140	0	40	0
1745	1,052	828	144	0	41	0
1832	2,083	1,600	183	8½	52	8½

By inspecting the above table it will be seen that experience pointed out the good effect of increasing the dimensions of 50-gun ships. The same undeviating principle appears to have been acted upon throughout; and after a lapse of 87 years, we have a 50-gun ship (*Vernon*) of 2083 tons, built to carry a round of shot of 1600 pounds; which amounts to this, that 50-gun ships are now just twice the *tonnage*, and carry just twice the *weight of shot* they did in 1745! But this is not all; for the similarity that has been maintained in the proportions of length to breadth, about which so much has been said, is strikingly coincident.

In 1745, length : breadth 3·512 :: 1.

In 1832, length : breadth 3·475 :: 1.

Captain Symonds is said to have developed some important *features* in ship-building, in having told the world that BREADTH gives stability; but it happens that the very ship (*Vernon*) which has been the subject of so much remark of late, retains the same proportion of length to breadth, within the *hundredth place of decimals*, that 50-gun ships had 87 years

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ago. Mr. Phineas Pett, the first scientific ship-builder in the service of this country, constructed "that goodly ship the *Prince Royal*," in 1610, with a beam of 44 feet, although only 114 feet long, making the proportion of length to breadth in the ratio of 2·58 : 1, which is rather more than *twice and a half* as long as she was broad. Sir Walter Raleigh says, that 35 feet broad and 100 feet long is a good proportion for a large ship. This is rather more than *twice* and *three-quarters* as long as she is broad. And Mr. Pepys states, that "the builders of England before 1763 had not well considered that breadth only will make a stiff ship." This is going 160 years back.

We anticipate the question, "Then why have not the well-known principles of building large ships been boldly acted up to before, instead of cautiously creeping on with a little more length, and a little more breadth, as if the advantages of increased dimensions were doubtful?"

Our reply is simply this; that it has hitherto been the policy of the Admiralty of England to confine the dimensions of men-of-war within the smallest possible limits, upon a principle of ECONOMY; for "it is well known that this country does not produce a quantity of timber sufficient to answer the demand for it; that the stock is gradually diminishing, while the consumption increases; and that our navy must soon depend upon distant countries for a considerable part of the supply." This was part of the Report of the Commissioners of Naval Inquiry in 1806, since which time our dock-yards have been, and still are, filled with foreign timber. But although the ports are now open, peace will not last for ever; the ports may again be closed against the importation of foreign timber, and the alarm so often felt about the scarcity of oak in the event of a war, though forgotten for a time, may be fearfully renewed.

In the *Quarterly Review* for April 1814, we find the following passage on this important subject. The language is plain and unqualified, and the article of which it forms a part is written with an air of so much confidence, and with so much minuteness in detail, that we really think it may be relied on as an authentic statement. "The accounts (says the *Reviewer*) of the Navy Board, or Board of Ordnance, will show that owing to an increased demand, and a failure in the supply, the price of oak timber has been trebled within the last twenty years. The accounts of the Navy Board will also show, that of the stock of timber in the King's dock-yards, five parts out of seven are of a description fit only for building of frigates and smaller vessels; and it might be shown that the supply of large and crooked timber has long ago *ceased;* and that a single line-of-battle-ship could not now be built after the old manner; but recourse has been had, not from choice, but necessity, to various expedients and con-

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trivances, in order to suppply the want of it by small timber. Such is the actual scarcity of large timber, that *Mr. Seppings*,* whom we have already had occasion to mention as an ingenious shipwright, and who is now one of the surveyors of the navy, has contrived a plan for building a 74-gun-ship entirely of frigate timber, in order to save from waste some part of the vast quantity of *small* oak timber now lying in his Majesty's dock-yards. It is a great mistake to suppose that we ground our opinion of a scarcity on this *economical* use of oak timber; it is not economy, but waste, which nothing short of absolute necessity could justify. It is a mistake to suppose that we ascribe this necessity to the great advance in price; we go upon stronger grounds—the utter impossibility of procuring large timber at any rate!!" This is something like a reason, and a very powerful one too, why former naval administrations did not build frigates as large as line-of-battle-ships, and why ships of all classes were restricted in their *tonnage*. If the policy of the past could be proved to be false, on the simple score of economy, it would not at all invalidate the principles of naval science, nor remove the necessity of establishing a scientific method of construction, which consists in combining all the essential qualities of a ship in exact proportion to their actual importance, so that no one quality shall predominate at the expense of another.

It may be remarked, by the way, that Professor Inman's earliest efforts in naval construction aimed at increased dimensions; that is, additional tonnage, for such classes of ships as he was called upon to construct. The *Volage*, 28 guns, recently returned from the South American station, is, by actual measurement, 521 tons. The lines which were proposed by Dr. Inman (1818), made her tonnage 529 tons, but the drawing was rejected because the tonnage was *too great*, the Professor having been ordered to construct a ship of 500 tons only.† According to the first drawing she was to have been 114 feet 10 inches long on lower deck, and her extreme breadth 32 feet; but the approved draught from which she was built, made her 113 feet 10 inches long, and 31 feet 10 inches broad, making a difference of *one* foot in length and *two inches* in breadth!!‡

Again, in 1819, two draughts were laid before the Admiralty for building corvettes; one of them was of the restricted tonnage, viz., 400 tons, and the other somewhat larger. The smaller draft was preferred, and built from. (The *Rose*.)

Had Dr. Inman been professionally a ship-builder, he might have

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* The *Sir Anthony Deane* of our day.

† Admiralty Order, 10th August 1818.

‡ Launched in 1825.

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thought it worth while to persevere in his endeavour to break through the trammels which thus confined his views of the theory of construction within the restrictions of tonnage; but he is not professionally a ship-builder—and he considers himself in his connexion with naval architecture, only as an instructor of mathematics. It has been his object to teach his pupils how to apply the known principles of naval science to an example of construction, his aim being to place his students into the service to make their own way before them; to overcome those practical difficulties, and combat those prejudices, which are often a check to the free exercise of science. He never, for an instant, imagined that he had made his pupils *perfect* naval architects, but concluded that he had qualified them to commence a difficult professional career, for the groundwork of which he held himself responsible. It was his practice to say to every student, in turn, prior to the completion of the accustomed course of studies, "Take a drawing of one of His Majesty's ships, of reputed good character; calculate her properties by the methods you have studied under me, and then prepare an original design of *equal tonnage*, which shall possess similar properties."

This explanation will probably remove some of the misapprehensions respecting the School of Naval Architecture. Persons who know nothing of the nature of the institution, ask, "What has this new school done?" "What new light has Professor Inman thrown upon the subject?" We could tell them that the institution has done a great deal towards making the neglected science of construction better understood; and if ever the School of Naval Architecture be brought fairly into action, they trust they will, after sufficient time has elapsed for the seed to take root and spring up upon its proper soil, afford satisfactory proof that the institution might long ago, if permitted, have made a proper return to the country for the money that has been expended upon it. "All they ask, is a fair investigation or impartial trial, to prove that they have not mis-spent their time; and that, when they shall be called upon, unshackled from the chains with which distrust has hitherto fettered their exertions, they will not be found deficient in any practical sense, wherein correct judgment is appealed to: and they do not hesitate to declare that their united efforts will, if protected from the impatient clamours of prejudice, gradually raise the Theoretical Construction of our Navy to that eminence which the Founders of the Establishment had a right to expect. They say *gradually*, because they do not pretend to any sudden inspirations on the subject, but are content to proceed upon those Philosophical Principles which must eventually be crowned with certainty in results, if not with entire success. If, however, *unqualified depreciation and erroneous statements are levelled at this Institution, and suffered to pass without*

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refutation, all the energies of its members must fail, and the least sanguine hopes of its Projectors be defeated. Give them the opportunity and encouragement hitherto withheld through the misrepresentations of their opponents, and they are willing to stand or fall by the success of their exertions." *

People now form their own opinions on the merits of public measures without being pointedly appealed to. They know and feel that public institutions are *their* institutions: and nothing will satisfy the country in these days, but a full assurance that national establishments and influential appointments, which become a charge to the State, are proportionably productive of national good. The School of Naval Architecture has put the country to some expense; and the appointment of an unprofessional ship-builder to the situation of Surveyor of the Navy, is another expense, for a supposed benefit to the science of naval architecture. The views entertained by the two parties are so very different, that they cannot both be right. Such very opposite opinions on matters of science can scarcely fail to be injurious to the best interests of the naval service; it may therefore be reasonably anticipated that the First Lord of the Admiralty will take an early occasion formally to give his countenance to some uniform mode of instruction,—some regular plan of education, which will ensure progressive advancement in naval science and an improving succession of naval architects.

Sir James Graham is a member of a liberal administration, and it fortunately happens that he is a man of active habits and searching investigation; evidently disposed to look into matters himself, and to rectify abuses of all kinds. The all-absorbing question of Reform, and the Consolidation of the Admiralty and Navy Boards, have been enough to engross his attention, and may have prevented that inquiry on his part into the real state of naval science in this country, which, when the embarrassments attendant on great changes have passed away, he will, perhaps, think proper to institute.

The fundamental principles of naval architecture are *not* misunderstood, but they cannot be made to work miracles. The union of theory and experience is not a sudden process, and cannot be effected in a day; but with moderate patience and great attention, the science of naval construction may, by reasoning philosophically and mathematically, go on progressively improving. "Men are not incapable of progressive im-

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* Extract from a pamphlet published in 1828, explaining the object of Government in instituting a School of Naval Architecture, in reply to an attack upon that establishment.

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provement, chained for ever like the brutes to the circle of individual attainment; doomed, generation after generation, to commence at one point and to tread the same round. No! human improvement, thank God, admits of successive advances; each generation starts from the ground at which the last had expended its strength in arriving; and this single circumstance is sufficient to carry the race to a degree of knowledge which it is impossible for us to conceive." The object of the naval architect, therefore, should be to accumulate and make a methodical arrangement of the experience of ages, so that the knowledge of many may be attainable by one; and then, by means of mathematics and the method of induction, to establish true principles to proceed upon. That would be the way to find a cause for every effect, and a reason for every inference; instead of making use of that "guess-work knowledge which is the creature of habit, not of reason—ever liable to the errors of custom and the prejudice of ignorance." That would be the way to make each successive generation better informed than the last.

We have endeavoured to treat the subject with all the candour we possess, and have spared no pains to represent it in a true light. Our firm conviction is, that the value of practical ship-building, with its contingent duties, is not, generally speaking, properly appreciated: and we apprehend that they who have had it in their power to encourage the advancement of naval construction on scientific principles, have not been aware that it is a progressive science, which can only acquire an extended and permanent character by cultivating pure mathematics, and applying its powers to that experience which is "not the experience of one man, or of one generation, but of all mankind in all ages, registered in books, and recorded by tradition."

In a spirit of respectful submission, we therefore conclude by suggesting that if the First Lord of the Admiralty had been pleased to sanction the continuance of the custom of selecting a Surveyor of the Navy from among the Builders of the dock-yards, among whom are always to be found good practical shipwrights of great intelligence and professional skill, we conscientiously believe that he never would have found cause to repent it; and if, in addition to this, though by no means as a secondary consideration, he had thought fit to allow of proper assistance in the Surveyor's department (be the surveyor whom he may) with a view to collect and apply all information available to scientific purposes, then would Sir James Graham have done that for the science of naval architecture which his most enlightened predecessors have had in view. The duties of a properly-constituted *Office of Construction*, combined with the practical talent which is to be met with in our Naval arsenals, would, for the first

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time in this country, give Ship-building the character of a SCIENTIFIC ART, And such is our confidence in Sir James Graham, that our hopes are yet vividly alive.

Hic patet ingeniis campus: certusque merenti
Stat favor: ornatur propriis Industria onis.

LONDON,
May 1, 1833.

FINIS.

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SCHOOL OF NAVAL ARCHITECTURE.

An Apology for English Ship-builders; showing that it is not necessary the Country should look to the Navy for Naval Architects. Effingham Wilson, 88, Royal Exchange.

"The First Lord of the Admiralty stated, in the House of Commons, that he was "advised and firmly persuaded, that a naval captain is more competent than any in- "dividual he could possibly select from the Ship-building Department, to fill the "office of Surveyor of the Navy."—Vide *Debates on the Navy Estimates*, June 29, 1832 (page 5).

THIS is a plausible and well-written pamphlet, assuming a mask of humility to obtain its ends, and a deferential respect to the First Lord of the Admiralty, which is completely at variance with the whole tenor of its arguments and assertions. It has evidently been submitted to the scrutiny of many, has been carefully revised and corrected, and its sentences weighed previous to publication. We think we could put our finger upon several passages, and ascribe them to the true writers. We can trace suggestions from the ex-navy board, ex-surveyor, and School of Naval Architecture, separately and conjointly, in this little work, which we consider it our duty to refute, because it is well, apparently temperately written, and has, we know, produced a greater sensation than these brochures in general do.

We have before strongly advocated the cause of Captain Symonds, who, after all, is, himself, his best advocate, as every day proves the advantages which are derived from his appointment to the office of Surveyor of the Navy, and the injury which has accrued to the country by the inefficiency of Sir R. Seppings. Every new ship launched by Captain Symonds adds to his reputation, and refutes all the malignity of his opponents. "Deeds, and not words," should be the motto over that officer's crest; many of those who were most opposed to him have acknowledged their error since the qualities of the Vestal have been known; while the errors of Sir R. Seppings are becoming every day more glaringly apparent. During the whole period of his holding the situation, he never built one good ship—the only one approximating to merit, was the Castor, whose lines after she was laid down, were altered so as to steal upon the models of Captain Symonds; but not only has Sir R. Seppings never built a good ship, but he has spoilt many which were good previous to his alterations. We have a floating evidence of this fact in the Caledonia, which always was considered as one of the finest vessels in our service. What is she now? She was taken into dock to be thoroughly repaired, her beam was increased one foot, to render her more buoyant—of course to raise her lower-deck ports higher out of the water. It was found that, in her new construction, one hundred and thirty-eight tons more of wood and iron were employed than in her former, and the expense of the repair was enormous. She is now afloat again: instead of carrying her lower-deck ports higher out

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of the water, notwithstanding her increased width of beam, she carries them lower. They are now five feet five inches, and formerly they were five feet nine inches, or five feet ten inches, we do not exactly know which, above the water line. In fact, the Caledonia, which has cost the country perhaps two hundred thousand pounds, is *spoilt.* But, as it is not our object in this paper to enter upon the demerits of Sir R. Seppings, we shall leave him for the present, with the remark, that Sir James Graham acted most judiciously in removing him from his situation.

This pamphlet attempts to prove that Captain Symonds is unfit for his situation, and, that the students of the School of Naval Architecture have been treated with great injustice, by a Surveyor of the Navy not having been selected from their body. To a series of arguments are attached a series of calculations, which, of course, to the major part of its readers must be unintelligible. We have examined them. The three first propositions we can disprove, and therefore we went no further. The fact is, that these are not in their place, without the writers of the pamphlet calculated that the public would exclaim—

> "As to what's incomprehensible,
> We dare be sworn 'tis full as sensible."

And we should have passed over this portion of the pamphlet, had it not been that there is a wilful miscomprehension of Captain Symonds' principles. We acknowledge, that Captain Symonds has not a facility of expressing himself lucidly, but this is more frequently the case with men of talent than with others. After all, it is a matter of opinion what is and what is not "bearing." Theoretical terms may be misunderstood, but there can be no mistake in the practical qualities of the Vernon, the Vestal, and the other admirable models which have been added to our navy by the superior talents of the present Surveyor. But we consider that Captain Symonds requires no advocate: we must at once come to the pith of the pamphlet, which is,—whether, in the appointment of Captain Symonds, the School of Naval Architecture have been treated with injustice; and whether, *in future*, the Surveyors of the Navy are to be selected from that body.

Captain Symonds, it is stated, when he first built ships, did not know how to make his own calculations. We will grant it, whether it be true or not. He had not been accustomed to it—but what then? He knew how ships were to be built; he detected the errors of others, and felt practically that he was right. How often is this the case? How often do you find the greatest talent in those who cannot write or read, but who, nevertheless, by the strength of their genius, obtain that practical calculation, which enables them to produce the most extraordinary results, unassisted by theory. There is no great mystery in these calculations. The rules are simple and constant, and easily acquired. We presume, that Captain Symonds knows them now; if he do not, and he will come to us, he shall be master of them all in a very few hours.

But Captain Symonds, it would appear by this pamphlet, is not a builder. He is ignorant of all the details of construction—don't know how to fasten his own timbers—don't know how much a matey ought to

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earn in a day—cannot measure their work, &c. Granted; we are not exactly sure that we know how to pudding an anchor, but still we may not be a bad officer nevertheless; and, as the boatswain has been brought up to it, we allow him to perform the task. It is ridiculous how the writers of this pamphlet jump from one extreme to the other. At one moment it is all theory, in the next it is all practice, which is so absolutely necessary. A want of either is sufficient; and as Captain Symonds, by their account, has neither, he must be doubly disqualified. Before we proceed farther, let us examine how their own arguments bear upon Sir R. Seppings, whom they would defend. They assert that a person not able to make his own calculations is not fit for the situation of Surveyor. Could Sir Robert Seppings make his own calculations when he was appointed? We remember him a dock-yard matey, of good promise, in Chatham Yard, never dreaming of ever rising to be Sir Robert Seppings, Surveyor of the Navy. We say not this to his disparagement, far from it; but at that time, his calculations were limited to his chalk and rule. We still think Sir R. Seppings would, if *controlled*, have proved a very efficient master builder; there he should have stopped. But a man who has arrived at his grand climacteric without troubling his head with a decimal or vulgar fractions, would find much more difficulty than Captain Symonds, who always had the powers of deep calculation, although he had never applied to the special rules necessary in calculating the line of flotation. We doubt if Sir Robert ever made his calculations to the last. Old dogs don't learn new tricks, and an infinite series in algebra is infinitely puzzling to a man who has passed the age of forty. Upon these two arguments, therefore, Sir R. Seppings was no more fit for the situation than Captain Symonds. In fact, the arguments of this pamphlet remind us of the battle of Waterloo, in which the French assert that the English were beaten, but did not know it—not knowing it, they marched to Paris. So it appears that Captain Symonds, being neither practical nor theoretical, cannot build a ship—but not being aware of his deficiencies, he has, in his ignorance, built the finest vessels which ever graced the English navy.

It is a fact, as notorious as it is true to the principles of human nature, that a technical education is the very worst on which to ground hopes of those splendid improvements, which have an effect so stupendous upon the destinies of posterity, and which appear to be more the effect of heavenly intuition than the result of unwearied and laborious reasoning. Centuries may roll away in incessant toil to obtain some grand secret, and the efforts and labour of men prove vain; but when the Deity thinks right to say, "Let there be light," there is light, not before, and that light is generally produced in the very opposite quarter from which it was expected. To a certain degree this may be accounted for. For instance, those who have been for a series of years employed in Naval Architecture, labouring at all the details, burthening their memories with what others have discovered, finding a fixed rule, and perhaps a reason for each fixed rule, are generally but the transmitters down to posterity of that which has been already discovered. Should even a brilliant idea

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present itself to their imagination, it is instantly met by ten others, founded upon prescription, and drilled into the very core of the brain by practice, which soon smother the original conception, and the man plods on as he has been taught, and as others have plodded on before him. His tools are in his hand, and he reasons with them more than with his understanding; to a suggestion, he answers with his pencil and a calculation; the compass and T square are with him arguments irrefutable. A man so educated, or rather so trammelled by education, is well fitted to make practical the conceptions of others, but to conceive originally, would be in him a species of heresy at which he would shudder. But let us look back, let us contemplate the registered events which have gradually lifted society from barbarism to our present state of refinement, and we shall perceive the truth of the above observations, by finding, that almost every discovery of importance, every brilliant production of genius, have almost invariably been the offspring of those not possessed of that technical education, which at first sight might reasonably be supposed to have originated them. These remarks have the character of universality. The lawyers, the practical lawyers are the very worst body to whom may be entrusted the revision of a nation's jurisprudence. For the best poems, the best plays, or works of fiction, we are not indebted to those whose life has been one of continued education. The universities, as a body, have given us fewer people of literary renown than any other class of men. Milton owed but little to them; Pope less; and Shakspeare—the immortal Shakspeare—absolutely nothing. The first idea of a steam engine originated not in a professed mechanist, but a reflective nobleman. The logarithms were not discovered by the professors of a college, but by Baron Napier, of Marchintown. The spinning-jenny, that prolific parent of all the vast machinery which now benefits the nation in her unbounded cotton manufactories, was the invention of a barber. Every department of science has gained more from those who have not been trammelled by technicalities, although they have been guided by general laws; and why? because they had nothing to unlearn—they stood upon the eminence of reason, and viewed the whole subject at once; they reflected for themselves, respecting but not worshipping authority, and, aided by practice, their theory was crowned with success.

Bearing in mind the above remarks, we will put it to any candid reasoner, whether, of all persons existing, a captain of a man-of-war is not placed precisely in that situation most likely to discover the merits and demerits in Naval Architecture—whether he is not likely to be the best judge of what a ship is and what she ought to be—and, knowing all this, the best able to furnish such a model as will remedy existing defects, and combine those advantages which he has practically proved? The naval architect builds the ship, the captain of her, ascertains her qualities; he has time for reflection, opportunity for observation to the utmost extent, and, by long practice and experimental working, he brings her under that controul, which almost verifies Byron's sublime idea,

"She walks the waters like a thing of life."

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He finds out exactly what she can do, where her powers fail, and *why;* and if there be a remedy for any deficiency in her construction, he can apply it. Sailors have an intuitive knowledge of ships, and can almost tell, by the *eye*, what their good and bad qualities may be. Habit has produced a discrimination which is almost equal to science; and the lines of a vessel, which the builder imagines are only to be found in the draught in his possession, are as clearly traced upon the retina of a practised sailor, as if the drawing were before him. The fact is, that the great duty of an officer in the command of a vessel now-a-days is to remedy the defects of the builder, and to make the best of a bad bargain; and, had their advice been attended to, instead of having been scouted with contempt by the late Navy Board, our naval architecture would have been greatly improved.

Although seamen have never been permitted to offer their advice upon ship-building, their practical suggestions, pertinaciously repeated, have been attended with more success; and what has been the result? —that all the late improvements have originated chiefly from naval officers; but in no instance that we can recollect, from the dock-yard. Let any one look at the fitting out of a man-of-war from the dockyard—what sort of a vessel is she? A disgrace to the service. No sooner is she in the hands of the officers, than she is equipped anew, at a great expense to the captain, and then she appears as a man-of-war ought to be. Are we indebted to the dock-yard, or to naval officers, for the iron tanks for water—Truscott's pump applied to them—the chain cables of Captain Brown—the capstern and compass of Captain Phillips—the rudder of Captain Lehon—Rodger's anchors—Harris's rope—and the numerous other improvements which have emanated from scientific officers?

The writers of this pamphlet charge Captain Symonds with not having invented a new system of ship-building, but having returned to the old system which had been abandoned, and which they acknowledge to have been correct. If so, how disgraceful has been the conduct of our Surveyors of the Navy, to depart from that which was right; and how satisfactorily does it prove the superiority of Captain Symonds, and his fitness for his situation! We agree with them to a certain extent. Captain Symonds has evidently based his models upon the old Gibraltar; but, at the same time, that he has availed himself of her good qualities, he has carefully remedied her defects. Captain Symonds appears to be led by an unnerring grand principle, which is, that, by repeated experiments, he will eventually produce a model which will require no iron ballast; that is to say, that the provisions and stores, when complete, shall be sufficient for her ballast, and she shall only require *filling up* as she lightens, to keep her sufficiently down in the water. If Captain Symonds succeeds in this grand desideratum, we think he will then, with the other qualities which he has already realized, have brought the building of men-of-war to the highest state of perfection which we may reasonably anticipate.

We shall proceed to investigate the claims which the School of Naval Architecture so arrogantly (for their pretended humility is nothing but arrogance) bring forward. And here we must stop one minute to condemn that political animosity which induced Sir Byam

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Martin and his confederates to extol the parties to an excess which has laid the foundation of their grievous error. To oppose and find fault with the measures of Sir James Graham, they found it necessary to prove damages, and this could not be effected but by elevating the School of Naval Architecture to a height which was as unwarrantable as it was untrue. Sir Byam Martin eulogises them as *highly-gifted* young men. Does Sir Byam Martin know the meaning of highly-gifted? It is difficult, even in these days, to find one highly-gifted man in a thousand; and yet, Sir Byam Martin has discovered that the whole School of Naval Architecture are *highly-gifted young men*. We have no wish to depreciate their talents, and have no reason to doubt, but that after the education they have received through the bounty of government, that they are well informed, and have a good knowledge of the theory of naval architecture; but, as to putting them on a level with the present Surveyor of the Navy, the idea is preposterous. But let us examine the present situation of these persons, and see if they have any ground for complaint—whether any provision has been made for them, after government has been at the expense of their education. We subjoin a list of the whole School of Naval Architecture, with the situations they hold, and the salaries attached to their office.

			Salary.
Richard Abethel	Assistant Master Builder,	Deptford	£400
Thomas Pretious	ditto	Pembroke	400
William Morgan	ditto	Chatham	400
Francis Laire	Foreman	ditto	250
John Major	ditto	ditto	250
William Parsons	ditto	Portsmouth	250 —
Samuel Reid	ditto	Chatham	250
William Rice	ditto	ditto	250
John Williams	ditto	Portsmouth	250 —
Isaac Watts	ditto	Plymouth	250
Henry Chatfield	ditto	ditto	250
James Bennett	ditto	Portsmouth	250 —
William Henwood	ditto	ditto	250 —
James Peake	ditto	ditto	250 —
George Cutfield	ditto	Plymouth	250
John Sheffield	ditto	Chatham	250
John Allen	ditto	Pembroke	250
Augustus Creuze	ditto	Portsmouth	250 —
Jeremiah Owen	Student	ditto	200 —
Thomas Lloyd	ditto	ditto	200
Archimedes Shaw	ditto	ditto	180
Henry Craddock	ditto	ditto	180
John Hancorn	ditto	ditto	180
W. R. Lang	ditto	ditto	180
Joseph Large	ditto	ditto	180
			£6250

It appears, then, that all the school have been provided for, and at an expense of 6,250*l.* per annum—no small sum in these days of necessary economy; and we must say, that when we consider the situation of the junior officers in our own service, when we call to mind that there are now about two thousand young men of family and education, who, after having served ten or twelve years as mid-

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shipmen, after having dedicated their youth up to manhood to the service of their country, are now remaining on shore without a fraction of half pay, these highly-gifted personages should feel most grateful. The economy so imperiously demanded by the country, and which has prevented Sir James Graham, who feels and acknowledges the unfair situation in which the junior officers are placed, but who cannot assist them—this urged economy appears to have been overlooked in providing for the School of Naval Architecture. Yet these persons represent themselves as neglected—not only neglected but unjustly treated; they assume that they have been induced by promises to enter into a profession, and these promises not having been fulfilled, that their prospects in life have been blighted. This is a serious charge which we must refute; and we must observe that, in our refutation, we are not stimulated by malevolent feelings. If there is exposure, the parties must thank themselves and Sir Byam Martin.

The first question which naturally presented itself, when we heard of the grievous injustice to which they had been martyrs, was, Who are these people, and what have they lost? What are the prospects in life which have been thus blighted? To obtain this information, it was necessary that we should make some inquiry into the means possessed by their parents to have forwarded them in life, through other channels. To obtain the whole information we found was impossible, for nobody knew from whence the major part of them sprang, and some, it appears, cannot legally make claim to any father. We now subjoin a list of all that we could collect, from which the original prospects of the remainder may be fairly estimated.

Richard Abethel,	his Father,	Reduced Measurer of Dock Yard.
Thomas Pretious,	ditto	A caulker in Woolwich Yard.
John Major,	ditto	A Mercer in London.
Samuel Reid,	ditto	In the Carriage Department, Woolwich Yard.
William Rice,	ditto	Lieutenant in the Navy.
Isaac Watts,	ditto	Custom House Officer.
George Cutfield	ditto	Master in the Navy.
John Allen,	ditto	Quarterman in Dock Yard.
Augustus Creuze,	ditto	French Teacher at Naval College.
Archimedes Shaw,	ditto	Clerk in the Dock Yard.
John Hancorn,	ditto	Clerk in Ordnance Department.
W. R. Lang,	ditto	Assistant in Deptford Yard.
Joseph Large,	ditto	Shoemaker, Chatham.
James Peake,	ditto	The late Surveyor.

Now, there are only two upon this list whose parents can be considered as respectable. Mr. Peake, the son of the late surveyor, stands alone; and the next to him is Mr. Rice, the son of a lieutenant in his Majesty's service. Mr. Rice is better off than his father, who probably supports a family upon a half-pay of 90*l.* per annum, while his son is in the receipt of a salary of 250*l.* But, taking them all, have they lost or gained in life by their present situations? What would they in all probability have been, if the government had not educated and provided for them? In every probability, journeymen manufacturers, and mechanics. And yet, they complain of injustice, because they are not made Surveyors of the Navy, and, of course, because they are not also knighted. It is really too preposterous. Even a

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student receives a stipend equal to the half-pay of a post-captain in his Majesty's navy, who has served his country for thirty years, and is covered with medals and honours. Richard Abethel and Thomas Pretious, sons of workmen in the dock-yard, cry out because government have educated them, and put them into situations of 400*l.* per annum, with a good house and allowances.

We should strongly advise these highly-gifted personages to be cautious—to write no more pamphlets; but to eat their pudding with thankfulness, and hold their tongues. We will tell them a secret. There never was 6,250*l.* per annum which could be so well saved to the country. Instead of being victims of injustice, their introduction has been an act of injustice towards the old servants of the public, occupied in the dock-yards, who, at *their own expense,* have educated their children to fit them for those situations now held by the School of Naval Architecture; we must also tell them, that they are of little or no use, too much puffed up with their own consequence, and too much above their business, sauntering about the yards, and picking their teeth with chips; and further, that if the major part of them were dismissed, the work of the dock-yards would go on much better than it does at this present moment. The founding of the school was ill-advised, and we trust that no more students will be admitted, or, that government will never again put itself in the situation of the man in the fable, who, as soon as he had cherished to life, by the warmth of his breast, the frozen serpent of the dunghill, was gratefully rewarded with its sting.

F. M.

THE PHILOSOPHICAL LOVER.

A TRUE ANECDOTE.—BY MRS. ABDY.

An heiress one morning elop'd with a youth,
Leaving kindred and friends in the lurch,
They arrived at the spot for exchanging their truth—
Just as "twelve" was proclaimed from the church.
"Our clock has gained time," quoth the sexton, "we'll send
For a ladder, its course to repel;"
But the lover replied—"Take no trouble, my friend,
To-morrow will do just as well!"

At the next village inn, a retreat they procur'd,
The lover arose the next morn,
And found that his fair one a chaise had secur'd,
And departed at break of the dawn:
"Did she leave not a word?" was his eager demand;
"Yes," the chambermaid hastened to tell—
"This message, she said, Sir, you'd quite understand,
"*To-morrow will do just as well!!*"

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AFFAIRS OF SPAIN.

STATE OF PARTIES.

The death of Ferdinand creates an era of the highest political importance. That death was anxiously looked to as the termination of a rotten, timid, and shuffling system of ruling, and considered as the precursor of a more energetic, clear, and decided order of things. As regards the end of the king himself, it was in every respect worthy of his career: it afforded a striking practical demonstration of the *animal* man, which so strongly preponderated in the composition of a sovereign, than whom history scarcely offers a parallel in the page of unfortunate and discreditable celebrities! The life of Ferdinand the Seventh was an uninterrupted series of treacheries—treacheries too destitute of that varnish of expediency, or gilded with that coating of genius and daring, which serve at least to delude the unphilosophic mind: intrigues of a despicable nature—paltry cabals and equally paltry motives, have played the most prominent part in the calamitous reign of a king who claims the cruel distinction of descending to the grave without a tear to grace his departure. Equally hated and despised by all parties, his remains are scarcely cold, when the expression of horror and contempt burst from the bosom where those feelings were compressed. No sovereign ever owed a greater debt to his people than Ferdinand—no sovereign ever repaid that debt with a blacker ingratitude. Fortune twice offered him the opportunity of working the felicity and regeneration of Spain; but his vulgar mind, in conjunction with his cold heart, had not sufficient courage to cope with his naturally unworthy propensities, even when the glorious prize of national renown glittered in perspective. In his first treachery against his father—his desertion of the Spanish people—his almost incredible baseness to Napoleon—his cruel ingratitude to the defenders of his throne—his constant duplicity to the Cortes—what reflections are offered to the attentive reader! But we will not enlarge on this humiliating subject—enough that Ferdinand, as if the calamities of his reign were not sufficient misery to Spain, bequeaths to that country at his death all the horrors of a civil war!

It was generally supposed—nay, confidently asserted, previous to the death of Ferdinand, that with him would expire the odious system of government in which he delighted—that his ministers would be displaced, and make room for the friends of the Queen, who were the avowed friends of social and political ameliorations. The Liberals were made to harbour the most sanguine hopes, and their cause became identified in anticipation with that of the Queen, whilst the banner of Don Carlos was to represent the power of pure despotism and religious intolerance. But the King dies, and the Queen Regent loses no time in putting forth a *manifesto*, evidently framed by Zea Bermudez, as it is a close transcript of his famous declaration

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of faith when he assumed the reins of government. We proceed to analyze this document, and refute its fallacy.

The object of the *manifesto* is to conciliate not only the Holy Alliance, but to calm the fears of those partizans of Carlism, whose adherence to the cause rests more on its principle, than on the person of the chief. The document courts the friendship and submission of the clergy by a conclusive declaration that religion, or, what is equivalent in Spain, monkism, intolerance, and ecclesiastical abuse, are to remain in their full vigour. It then proceeds to declare, that no "innovations whatsoever will be admitted into the country." This is equivalent to a declaration of war against the Liberals: it places the matter at issue in the light of a simple family question, and the struggle is to be merely between two persons, and the reward of the victor a crown; the nation has nothing to do with the affair further than receiving the blows, and enduring the calamities attendant on the contest. But the *manifesto* is a precious document, as it throws a most extraordinary mystery over the views of the party called *Christinos*, and brings to light the pretended tendency to *liberalism* attributed to the Queen Regent. Now, we candidly ask, what is the meaning of the party called *Christinos?* what their views, their political creed? We can very well comprehend what a *Carlist* means, and what a *Constitutionalist* wants. Perhaps the *Christino* is a *juste-milieu:* no—the *manifesto* contradicts this supposition. Don Carlos himself, had he been on the throne, could not have put forth a more ample exposition of *his* system of government. The only satisfactory conclusion to which we can arrive, is, that the Regent's party are in views and wishes much the same as *Carlists*, only that they have not the virtues of honesty and moral courage of the latter; and that they prefer to achieve by intrigue, and truckling, and sophistry, the object which their adversaries have the manliness openly to avow, and boldly to maintain. The struggle, therefore, as it now stands, is one merely of personal ambition; the delusion which fondly coupled this contest with more sacred and enlarged views, must, by this time, be dispelled. Those Liberals, who are worthy of the name, have now the line which they are to pursue clearly traced out. They can only support a *person*, as far as in that person they behold the representative of a principle. From the moment that this person clearly and distinctly disavows and repudiates this principle, they of course, having lost the stake which they had in the game, must look on the contest with indifference and preserve neutrality.

Perhaps succeeding events may teach the present arbiters of the destinies of Spain, that ignorant, and fanatic, and corrupt as the Spaniards may be, they are not yet so imbecile as to be twisted and turned like puppets, at the mercy of designing and anti-national men—that an enthusiasm and self-devotion are not to be created and called forth from *nothing*—for really we are as yet at a loss to conceive the titles of a babe three years old to the affection and blind submission of a whole people. To bring forward the will of Ferdinand amounts almost to a joke, and surely, no one will be stupid enough to allude to the sanction of the mock Cortes, which assembled to swear the young

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Infanta, and whose convocation, it would appear, was meant not so much to invest the ceremony of the *jura* with a sacred and national character, as to exhibit the utter contempt in which the rulers of Spain held every thing bearing the remotest affinity to popular representation. Thus we find, that the Queen Regent's party, or the *Christinos*, is composed of those who derive immediate emolument, power, or protection, from the existing government. The great portion of the army is also in their ranks, although it is problematical how long they will remain faithful. Apparently, too, though the *Christinos* seem the national party, it is the most *unnational* of the three. It possesses no characteristic feature of its own, nor are the men who play the principal parts likely to inspire much confidence —no, not even to themselves. They are all playing a deep game, how each one may overreach his fellow in intrigue: their ambition being merely personal, falls universally below not only that of the *Constitutionalists*, but even of the *Carlists*, who have a definite object in view, and who, although misguided and fanatic, are yet *sincere* in their folly and fanaticism.

Those who mingle together the *Christinos* with the *real* Liberals, labour under a strange and mischievous error—mischievous, inasmuch as they tend to spread wrong impressions, and excite sympathy and interest under false pretences, if we may so express ourselves. Whatever might have been the relative situation of the *Christinos* and the Liberals towards each other, previous to Ferdinand's dissolution, it is clear that they had no one interest in common from the moment that the Queen's manifesto was proclaimed. Succeeding events may perhaps approximate these two parties; but let it be with an admission of the principle—a concession—a pledge—a conviction that the *Liberals* do not forget themselves so far as to retrace their steps three centuries back, and work merely to answer the purpose of individual ambition and family interests, in which the country at large has no share.

The party of Don Carlos has already begun its work; the Basque provinces are in a state of revolt, and it is justly anticipated that the flame will spread through the various other portions of the Peninsula. Still, some persons are surprised at the little progress made by Don Carlos; we are not, nor will any one else, who is aware of the vast resources held by a government *de facto*. It possesses a power which must be wrenched from its grasp: then the thousands and thousands who derive their importance or subsistence from that power, naturally enough cling to it for the time being, whatever may be their hidden views and partialities. But some persons will pronounce themselves more strongly, as their interest or their safety may require. We have no doubt that many of them are *Carlists* at heart, whilst the great majority have no fixed principle to guide them, further than the "powers that be." Thus, as far as a spirit of party is concerned, we conceive that of the Queen the weakest; it can only derive an accession of real strength from its junction with the *Carlist* or the *Liberal*.

The attempt to conciliate the *Carlists* by the promise made in the *manifesto*, is a clumsy, no less than a despicable attempt to impose on the nation. Does the framer of that precious document suppose that the sincere *Carlist* will be trepanned into the net? No. Why

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should he desert a chief whose principles are fixed, stern, uncompromising, to join a more vague, truckling, and untried standard? Can any one suppose for a moment, that a little infant, exposed to the thousand chances consequent on a long minority, offers to the party the same security, as a vigorous, adult, and immediate ruler? Why should the *Carlists* abandon a chief in whom they confide, whose person they love, and whose interests are intimately interwoven with their wishes, merely to try a hazardous experiment, from which, in case of success, they have nothing to expect but a diminution of influence and importance? We conceive this *ruse* totally in vain. It does not gain a single *sincere* adherent to the cause from the *Carlist* party, whilst it alienates the whole of the Constitutionalist or Liberal. Thus, the *Christinos* are reduced to the military and civilian armies, who prey on the state—the mass of the nation, as it is called, is actuated by a most comfortable indifference, and will follow the leader who appears the most powerful for the time being.

We have advanced that the Queen's party, as it is at present constituted, is the least national of the three, and we are now prepared to bear out our assertion. The intrigues and movements of the French government are not secret: it is clear that an unjustifiable intervention will take place, should the occasion require—that is to say, if the Queen of Spain is repudiated by her people, why then she must be supported by foreign power, and the Spaniards must swallow a ruler *despotically* imposed on them by *constitutional* France. Nothing can be imagined more unjustifiable, atrocious, and base, than this intended intervention. Let the Spaniards fight their own battles, and settle their quarrels as they best may; then it will be easy to arrive at a true conclusion as to the wishes of the nation; the strongest will prevail, and the Spaniards, after the various vicissitudes of civil war, will at length settle into that *form* of government which they really wish. If they are anxious for liberty, they will have a fair opportunity to exhibit that predilection. If, on the contrary, they are enamoured with despotism and religious intolerance, let them enjoy those blessings by all means, and leave them to decide from which person they prefer those benefits to flow. Do not oblige them to receive the favour from the little Queen Isabella, if they prefer the castigation from the more vigorous arm of Don Carlos. It will be hard, indeed, if the Spaniards are not even allowed to choose their own executioner, and be flagellated according to their own fancy and predilection.

Among the various causes assigned for the wretchedness and moral prostration of Spain, and among the obstacles put forward against the welfare and prosperity of that unfortunate country, the principal reason, as well as the most serious obstacle, is generally overlooked or omitted. We have heard much concerning the supine ignorance and humiliating superstition of the Spaniard—much concerning the ascendancy of the clergy—the total corruption of men in power—the demoralized state of the army—the lamentable apathy of the mass, and so forth; but we seldom hear, among this enumeration of evils, the most dangerous one put forward, viz. the vicinity to France, and the constant exhibition of French influence in the affairs of the Penin-

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sula. Whether from a despotic ruler, or a *soi-disant* constitutional king, Spain is equally doomed to suffer in her independence. It would seem, that the wretched nation is under the tuition, not to say subjection, of France, that it cannot arrange its own affairs without French interference. The deep and ambitious designs of Louis Philippe ought to arouse every sincere lover of his country, whether Carlist or Liberal—the latter especially, we caution to beware of the machinations of that most bitter, most hypocritical, and despotic enemy of real liberty.

With regard to the incidents of the drama now performing in Spain, little is known with certainty. The most contradictory rumours are spread to serve stock-jobbing purposes, or temporarily to amuse the imagination of the reader. At this moment, little is ascertained beyond the fact that a portion of the Basque provinces is in a state of open revolt. Bilboa, Vittoria, and Logroño are the principal places in the possession of the Carlists: how long they will remain so, or how much further, or with what degree of celerity, the insurrection may spread, we do not pretend to foretell. The plans, the proceedings, nay, the very fate of Don Carlos, are, at the moment we write, involved in mystery. Most of the public journals represent his cause as completely lost; but we apprehend they are premature in their conclusions. We really cannot reconcile a tame surrender of the crown, with the explicit protest issued by Don Carlos against the recognition of his niece as the future sovereign of Spain. Nor can we be blind to the great power of the clergy, and to the deep-rooted hatred and uncompromising tenacity which marks all their proceedings in defence of their supposed rights: these rights they fancy now immediately threatened, and it will be a marvel indeed, that they should tamely submit to the rule of men whom they erroneously conceive tainted with the poison of liberalism. Besides, the English journals receive their impressions from the French, which are now deeply interested in representing the cause of the young Queen in the most favourable colours.

The invitation to the constitutional chief, Jauregin, (El Pastor,) to join the cause of the Queen, and his prompt acceptance of the offer, has produced considerable surprise and speculation. The Liberals, who are, generally speaking, endowed with most sanguine temperaments, on whom all the lessons of experience seem lost, and whom all the blows of adversity cannot render more cautious—the Liberals already see in this demonstration a good foundation to erect a structure of towering hopes. They have commenced building *chateaux en Epagne* with all possible alacrity: and, in the very face of the plain-spoken *manifesto*, they hug themselves in the idea that the Queen's party are secretly working in their behalf, but, that from prudential motives, the said party refrains from avowing openly their alliance with the Constitutionalists. We consider this one of the most fanciful delusions that can well be imagined, as we do not clearly see the necessity for this *secret marriage*. Is it to deceive the Holy Alliance? —monstrous absurdity! We know who are the real dupes at this present moment—certainly they are not the *Christinos* nor the *Carlists*.

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Will this *soi-disant* system of the *juste-milieu*, or more properly speaking, this *pure absolutism* in disguise, be able to obtain permanently in Spain? We think not; the mask must be put aside some time or other. Jesuitism must cease, and things will then be called by their real names. The Queen Regent will govern them with all the despotic sway of her predecessor, or with the avowed admission of liberal institutions. The *Christinos*, we apprehend, have some definite opinion—some views—some design in contemplation; what these opinions, views, and designs may be, we are totally unable to decipher. But if the letter of the *manifesto* is to be their standard, we humbly submit to our readers, that the said *Christinos* present a distinction without a difference, and that they are Carlists to all intents and purposes except the name. If, on the contrary, they have other prospects in view, we are puzzled to determine why they should take the longest way to arrive at a certain point, when the same journey may be performed by a much shorter road.

We are obliged for the present to stop; we will recur to the subject, as we apprehend that the affairs of Spain will afford ample matter to justify our task.*

* We are compelled also to postpone our remarks on a most curious and interesting work relating to Spanish affairs within the last ten years. We allude to *Espana bajo el poder Arbitrario*, &c. 1 vol. Paris, Baudry; London, Boosey and Co.

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IMPRISONMENT FOR DEBT.[1]

A TRUE STORY.

The general tenor of the conversation, as in all ignorant societies, was that of politics, and settling the affairs of the nation, for there are always wiser heads out of the Cabinet than in it. This conversation was kept up with a degree of warmth that did great credit to the patriots and champions of civil liberty. Here ministers were dismissed, and generals appointed; the finances of the country placed on a more respectable footing, and the national debt put in a better train of liquidation; and all this was done by men who had not in their pockets the price of a second pint of porter!

These political discussions, which were more noisy than profound, were occasionally diversified by songs and duets, some of which were neither destitute of taste nor science, and the lover of harmony might exclaim with Othello,

> "If after every storm come such calms,
> May the winds blow Olympus high."

About ten o'clock, the hilarity of the club was stopped, and its enjoyments suspended, by the appearance of the officer "who holds the office opposite to St. Peter, and keeps the keys of hell," vulgarly denominated a turnkey, who came at that hour, attended by a group of myrmidons, howling like Cerberus, and frowning like Michael Angelo's Neptune, to tell us our hour was come, and to lock us up in our dungeons. The severity of this fellow's muscles were somewhat softened by a sop, in taking *toll* out of every man's mug of beer, for a prison is the very hotbed of bribery and corruption. Having finished his draught, he brandished the tremendous *insignia* of his office, (a bunch of immense keys,) on which signal the *house rose* simultaneously, and its members immediately disappeared, "melting like ghosts before the new-born day."

This interruption was most *mal-apropos*, and, indeed, ungrateful on the part of government, as the company were then singing, in full chorus, "Britons never shall be slaves." Till after the dissolution of the club, when he found himself again in the yard, it never once occurred to Tomaso, that he had not yet provided himself with a lodging for the night; for though he had the range of the Grand Hotel, he had no room assigned him in which he was to sleep. This was a grievous oversight; and as no person was so *ill-bred* as to trouble himself with what did not immediately concern him, this trifling inattention on his part, left him somewhat in the situation of the babes in the wood—the melancholy resource of wandering about all night in an unknown region. The whole population of the prison were gone, or were going, to rest, and poor Tomaso had not where to lay his head; and he discovered, when too late, that he was as yet a novice in prison discipline. Being now *solus*, he had ample scope for contemplating the starry heavens, or ruminating on the "various turns of chance below," in which dilemma he remained, sauntering about the yard, till after midnight; making in his *tour* of the prison suitable dissertations on a state of eternity! At this critical juncture the door of the tap, or coffee-room, flew open, (behold, how romantic!) and out bounced two gentlemen, who, having made their *entrée* to the prison while the club was sitting, remained *tête-à-tête* till their beverage was exhausted; when, like the hero of La Mancha, they sallied forth in search

[1] Continued from p. 207.

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of adventures, forgetting the limited confines of their peregrinations. Finding one solitary person perambulating the *play*-ground, and being soon roused to a sense of their situation, (for they were more than half seas over,) they, with Tomaso, like some of the heroes of the Iliad, resolved to "maintain the watch of night," and take care that no ragged ruffians should break *into* the prison, and disturb the midnight sleepers. But having laid *in* too much of that potion which "steals away men's brains," and being powerfully importuned by the suggestions of Somnus, it was resolved *nem. con.* that they should change their plan of operations, and retire to the coffee-room till morning. Here the three *outcasts* took their stations, (for though confined within the walls of a prison, they came under *that* denomination.) One of these gentlemen was a Scotch merchant, and the other was a dancing-master from Richmond, in Surrey. They were perfect strangers to each other, but having met at the same spunging house, they fraternised and came to prison together, where their slight acquaintance was, by their mutual misfortune, cemented into friendship.

The Scotch merchant took possession of a long table, on which he extended himself at full length; the dancing-master stretched himself out on a form, and Tomaso took possession of the great chair; on which the president was wont to sit on *state* occasions; exclaiming as he sat down, (in the words of Richard, on the eve of the battle of Bosworth Field) "Here shall I rest my head to-night, but where to-morrow?" In this *fauteuil*, or great chair, like some other presidents, or *judges*, he was soon caught *napping*.

Fortunately for the *trio* who now occupied the *Rose*, the weather was then uncommonly warm, else they must have suffered severely, as that apartment, or appendage, was merely an excrescence stuck on the general building, and composed on three sides of thin deal boards, so badly caulked, that it was only calculated for a summer's retreat, resembling more an Oriental retiro, than an English structure. After a most restless night, filled up principally by such conversation as two tipsy and one sober man may be supposed to have sustained, the company one after another slumbered into silence. When a man is tipsy, his real character is said to come out, as, if he has a particle of vanity, it is sure to manifest itself when he is sitting for his picture.

The Scotchman, like most of his countrymen, was a man of education, and great civility of manners; and might have been an agreeable companion, had he not been unintelligibly inebriated. As for the dancing-master, he was as destitute of intellect, and as empty, as his own violin, though not quite so agreeable a companion.

"Tired nature's sweet restorer, balmy sleep," had scarcely taken possession of the company in the *Rose*, the name of the room, when the infernal bawling of the prison watchman roused them from their slumbers, and utterly destroyed their repose. This fellow, whose duty it was to guard the place and preserve tranquillity, *slept* all night, and rose early in the morning to get drunk and disturb those who stood in need of rest. He entered the room, to which every person who paced the yard had free access, and vociferating the words, "Rise and fight," which in the vulgar language of the place, means, get up and give something to drink, and this he bellowed in a voice "that would have awakened death." This beast, who had a face red as Beelzebub, had also, like a true infernal, an inexhaustible and burning thirst, which nothing could slake or satisfy, and to whom a glass of gin would be like pouring a kettle of water on a lime-kiln, which would have no other effect than that of setting it hissing for more. Of this miscreant, in whom was combined every property that constitutes a brute, more shall be said hereafter; as he was too *great a character* in the place to be lightly passed over.

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The sun being now high, shed a genial warmth over the atmosphere, and rendered it pleasant for walking, even in the confined district of a prison yard. Between six and seven o'clock the whole of the population were on the alert; even the ladies came out of their hiding places, to taste the freshness of the morn. Among the rest, Mrs. L—— left her shade, or rather her shed, to join the gay throng on the promenade; and coming up to Tomaso, and giving him a gentle squeeze of the hand, hoped she would have the pleasure of his company to breakfast in her *hut;* to which he readily assented, provided she would allow him to bring his own *materiel,* and that she would have the kindness to keep him in *hot water,* for in a prison, it requires very little sagacity to discover that a meal of any sort is a thing of too much importance to expect for nothing. After replying, with a line from Goldsmith's Retaliation,

"Let each guest bring himself, and he brings the best dish,"

she cheerfully assented to the proposition. Having therefore freighted his pockets with tea and sugar, (which may be purchased in the place,) and waiting the coming of the baker with hot rolls, who punctually arrives at eight o'clock, Tomaso hastened with his provender to the *Muse's bower,* and not wishing to be outdone in quotation, (for which the reader may perceive he had a sort of itch,) he entered with a line from the ballad,

"Hot rolls and butter break the Briton's fast,"

he then sat down with keen zest to a cheerful and abundant repast.

The conversation commenced by inquiries on the part of the lady, how he (Tomaso) liked the club, and his new society; to which he answered, that *such* society was indeed new to him, and as such, had the usual recommendations of novelty. On receiving this somewhat equivocal answer, Mrs. L—— opened to her guest a door of information, at which he was at once shocked and astonished; and which exhibited to his "mind's eye" as many frightful images as that of opening the door of the chamber in Blue Beard, or the last scene in the phantasmagoria. This was a brief account of those who composed the members of the free and easy, and was as follows.

Lieutenant G—t—n, of the R—— N——, was what is called a state prisoner. The crime for which he was then confined was, she said, of so dark and diabolical a nature, that she dared not even hint at it; so enveloped in mystery was the whole transaction. The lieutenant was an uncommonly fine young man, of pleasing and genteel manners; but he always appeared with such an air of melancholy, as showed he felt his situation. He seldom appeared in public, but was frequently visited by his mother and two sisters, who seemed to be persons of great respectability, and who afforded him every comfort and consolation of which his situation was susceptible; but they also appeared in a state of great dejection. Whatever may have been the ultimate fate of this unfortunate young man, whether corporal punishment, degradation of rank, or long confinement, has never reached the ears of the author of this brief biographical notice; he having left the lieutenant behind him in prison, and never having heard of him after.

Andrew Tho—p—n, the little hunchback tailor before mentioned, was a great character, and a consummate schemer, and since that time has turned out a notorious swindler and incorrigible villain. This fellow, who certainly was not deficient in talent, arrogated to himself the merit of being the original projector of the Naval Asylum, and complained bitterly of the neglect of his merit, and the ingratitude of his country, on the score of the latter; however, he has been made some amends, his country having paid the expense of his voyage to New South Wales,

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tained. But in how few cases is this possible! We have but one Junius in the world. At the present day there is not a journal existing in which, while the contributors are concealed indeed from the world at large, they are not known to a tolerably wide circle of publishing friends. Thus, then, in a critical point of view, the advantages supposed to spring from the anonymous vanish into smoke. The mask is worn, not to protect from the petitions of private partialities, but *to deceive the public as to the extent to which partiality is carried*; and the very evils which secrecy was to prevent, it not only produces, but conceals, and *by* concealment defrauds of a remedy. It is clear, on more than a superficial consideration, that the bias of private feelings would be far less strong upon the tenor of criticism, if the name of the critic were known; in the first place, because the check of public opinion would operate as a preventive to any reviewer of acknowledged reputation from tampering with his own honesty; in the second place, because there are many persons in the literary world, who would at once detect and make known to the public the chain of undue motives that binds the praise or censure of the critic to the book. Thus you would indeed, by the publication of the reviewer's name, obtain either that freedom from private bias, or that counterbalance to its exercise, of which, by withholding the name, the public have been so grossly defrauded. Were a sudden revelation of the mysteries of the craft now to be made, what—O what would be the rage, the astonishment, of the public! What men of straw in the rostra, pronouncing fiats on the immortal writings of the age; what guessers at the difference between a straight line and a curve, deciding upon the highest questions of art; what stop-watch gazers lecturing on the drama; what disappointed novelists, writhing poets, saleless historians, senseless essayists, wreaking their wrath on a lucky rival; what Damons heaping impartial eulogia on their scribbling Pythias; what presumption, what falsehood, what ignorance, what deceit! what malice in censure, what dishonesty in praise! Such a revelation would be worthy a Quevedo to describe!

"But this would not be the sole benefit the public would derive from the authority of divulged names. They would not only know the motives of reviewers, but their capacities also; they would see if the critic were able to judge honestly, as well as willing. And this upon many intricate matters; some relating to the arts, others to the sciences; on which the public in general cannot judge for themselves, but may be easily misled by superficial notions, and think that the unknown author must be a great authority;—this, I say, in such cases would be an incalculable advantage, and would take the public at once out of the hands of a thousand invisible pretenders and impostors."

We agree that the anonymous has much to answer for; it enables a petty and malignant fellow to throw dirt upon his betters; but still to *oblige* every party to put his name to what he writes, is really an infringement of the few real liberties we possess in this country. With all its disadvantages, we therefore say, let people write with, or without name, as they please. If a work is really good, can it be written down?—Never. Much dirt has been thrown upon Mr. Bulwer; but has it hurt him? We answer—No! In these remarks Mr. Bulwer shows that very sensitive feeling he has to abuse—a fault as an author not to be courted, but one that will interfere much with his happiness. He should look upon it in a different light. Next to praise, which is the most agreeable, abuse is infinitely preferable to contemptuous silence. Now-a-days, it's a feather in a man's cap to be worth abusing.

Mr. B. has, in the paragraph quoted above, stated the argument as strongly as possible; but even in the very first instance, by Mr. Bulwer's own showing, the anonymous is not the secret. If the critique be unjust, illiberal, or slanderous, the writer is not sheltered either from public indignation, or from private punishment. We think, that all through this quotation Mr. Bulwer is begging the question, by supposing that the world cannot as easily select and repudiate a bad criticism as it

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can a bad work; and that persons who can only *guess* the difference between a "straight line and a curve," can, by any possibility, criticise so plausibly, that the most obtuse of all fog-surrounded publics should listen to him for a moment. Alas! we fear that, on this subject, Mr. Bulwer is too much inclined to join the cry that pervades, at this moment, every class of society—"There are too many of us!" He wishes that the Temple of the Muses should be more select; and, that none should gain admittance, but those who previously send up their name on an embossed and gilt-edged card, and whose entrance should be made to depend upon the sufferance of those persons who have already established themselves in that enviable location.

We maintain, that all authors should be allowed the privilege of the anonymous, because it is convenient, because it is just, and because it is beneficial to the public. That it is convenient, we need no other proof than the very general practice that it obtains. Its justice is founded upon that liberty of speech and action, that all institutions should secure to its members, the abuse of which liberty is, with us, too amply provided against by our law of libel; and it is beneficial to the public, because now, under the sanction of its practice, every man, who has the necessary talents, can enter into the literary circle without having on a "wedding garment," and have a fair chance of being heard upon his own merits. In a word, the privilege should be preserved, because its principle is eminently anti-aristocratical.

After Mr. Bulwer has discussed this subject very fully, and though he has taken the *ad captandum* side of the question, we think very unsatisfactorily, he then proceeds to give some very elaborate criticisms on the writers of the present and recent day. That these writers have conjointly a commanding influence on our intellectual character, it would be idle to insist upon. That they have had a beneficial one, is another question. Modern authors are now almost universally read nearly to the exclusion of the productions of the mighty dead. We insensibly take the tone of our thoughts from those with whom, and with which, we habitually converse. Whether we derive such conversations from books or from the breathing man—whether our present silent admonitors—and the silent will always give a colouring to our vocal ones—be now as useful, as elevating, or as replete with sound morality, as those that were popular in the time of Queen Anne, it would take up too much of our limits to examine. It is however certain, that in all the exact sciences, we have made vast discoveries; and we are now looking anxiously about us, to see in what quarter we may be enabled to extend the utility of refinement, and accumulate a greater mass of sensual enjoyment, instead of cultivating the lofty dreams of poetry, the exquisite graces of language, or the all-commanding and god-like power of oratory.

We were always of the opinion, that Lord Byron's plays were the best of his works; and, we think that the day is not far distant when they will take that commanding station on the stage, that they now hold in the opinions of most reflecting men. As yet, they cannot be said to have had much influence upon the public taste. We maintain Byron to be the legitimate successor to Shakespeare. In his early and more meretricious performances, he was but schooling himself: he

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was but learning his art when he produced what the world hailed as master-pieces; and, when he really produced master-pieces, the misjudging of the world fancied that his genius was verging towards a second childhood.

All that succeeds these strictures, up to the point where the book that is under our notice treats of the drama, is finely written, and eminently instructive. On the theatrical question, we think that our author is pointed, yet vague; he flashes upon our paths instantaneous lights, but they intermit; they do not assist us on our way; they dazzle us for a moment, and then, leaving us, make the succeeding darkness the more profound. He sets out with what we think to be a fallacy—that the public will not purchase their own amusements. All of the public who are just beyond panting for the very necessaries of life, will purchase their amusements, provided that they be made sufficiently amusing. All connected with the dramatic art in this country, have sought for too great a remuneration; and the public could not buy one expensive amusement that they love, by sacrificing ten less prized, but perhaps more durable, though certainly less intense, in enjoyment. Lure the public by low prices into the habit of visiting the theatres, and it will not be long before the theatres again flourish, and the public will become again dramatic.

The moral philosophy that is now most prevalent in England, though its prevalence extends the least in the world, in practice, is that founded upon the utilitarian system, upon which Mr. Bulwer is very witty, and against which he is very severe. He is thus sarcastic upon the greatest happiness principle.

"'The greatest happiness of the greatest number' is to be our invariable guide! Is it so?—the greatest happiness of the greatest number of men living, I suppose, not of men to come; for if of all posterity, what legislator can be our guide? who can prejudice the future? Of men living, then?—well—how often would *their* greatest happiness consist in concession to their greatest errors!

"In the dark ages, (said once to me very happily the wittiest writer of the day, and one who has perhaps done more to familiarize Bentham's general doctrines to the public than any other individual,) in the dark ages, it would have been for the greatest happiness of the greatest number to burn the witches; it must have made the greatest number (all credulous of wizardry) very uncomfortable to refuse their request for so reasonable a conflagration; they would have been given up to fear and disquietude—they would have imagined their safety disregarded and their cattle despised—if witches were to live with impunity, riding on broomsticks, and sailing in oyster-shells;—*their happiness* demanded a bonfire of old women. To grant such a bonfire would have been really to consult the greatest happiness of the greatest number, yet ought it to have been the principle of wise, nay, of perfect, (for so the dogma states,) of unimpugnable legislation? In fact, the greatest happiness principle, is an excellent general rule, but it is not an undeniable axiom."

Now this is very pleasant reading, but very bad argument; the *permanent* happiness of no man, or of no body of men, can consist in a concession to their greatest errors. Mr. Bulwer leaves duration of enjoyment out of the question. A person may make a present pleasure so intense as to ruin his future health, nay, even to hasten his dissolution; but, by so doing, he is not seeking his *greatest* happiness. And when he says that the happiness of the witch-burning bigots consisted in the making a bonfire of an old woman, he forgets what a greater happiness it would have been to the bigots, and to the old

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tuated by the same motives, and speculating on the same views—they are all struggling to get money, and the question of "art" and "patronage of talent," are to them empty words. They will all alike follow the course which they conceive most likely to respond to their projects—they will be guilty of the same follies—act with the same want of judgment, and afford the same amusing specimens of self-conceit, or petty authority, as an occasion may offer to call their exhibition into play.

The assertion, therefore, that the minors are a sort of nursery for rising talent—that they will repair the blunders and correct the injustices of the majors—is either a delusion, or conceals a most consummate piece of knavery. What possible interest can a mere speculator, (a speculator, too, many a time without sufficient capital to carry him through two or three months, and trusting to the receipts,) feel in the progress and splendour of the "dramatic art?" The only "art" to which he will be alive is, that of filling his own coffers in the shortest possible time, and by all possible means. Without meaning any disrespect to, or in the least criminating the characters of any of the managers at the head of the minor establishments, let us candidly inquire, "Are they persons whose stations in life, independent fortune, literary attainments, and rank in society, befit them for so responsible a part as that of 'fostering and protecting' the drama as a liberal art?" Certainly not.

Let it not be supposed by this, that we advocate monopoly—a monopoly, by the bye, of ruin, if we are to judge from the preceding seasons. We only contend, that when popular sympathy is endeavoured to be excited, it ought to be for men or things, which possess real and just title to such claims. Above all, it is folly to wish to judge of English dramatic matters by the standard of French theatricals, and to point out measures and remedies which cannot be followed, on account of the totally different system adopted in such affairs by the English and French nations. The prosperity of the national drama is, in France, a national question—an *item* in the glories of the country—a subject to interest the public at large, and to deserve the protection of the government. In England, on the contrary, it is a mere speculation—a speculation, too, of a vague and most contradictory nature. For, whereas, in every other branch of human industry, the title and capabilities of the speculators are considered and well weighed, nothing is required of the theatrical adventurer but to give fair security for the payment of rent: literary talent, experience on the subject, and command of capital, or high character in society, are lesser considerations; for, by the mere transformation of a man into a manager, he becomes, as if by miraculous process, suddenly invested with all the requisites for the discharge of the task. A mediocre actor, a discontented underling, a broken-down tradesman, or a woman, provided she possess, a good voice or a pretty pair of legs, are fully competent to speak *absolutely* on theatrical matters, to judge of the merit of performers, and to decide on the productions of literary men.

The patent theatres are now under the guidance and direction of one individual. It would be unfair to begin the task of censure be-

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fore we have time to see how the system works. Success will characterize, whether praise or condemnation is to be dealt. This, certainly, will appear a most unphilosophical decision; and it would be so indeed, in any other human matter except—the theatre! If the patent theatres succeed in amusing the public, their object will be fully answered. The question of the "*legitimate drama*" is a mere word; for, if the government and the public appear indifferent to its success, it will be an exuberance of Quixotic folly in a knot of particular persons to contend against such fearful odds. The said indifference will amount to a concession, that in the eyes of the government and the public, the "*national drama*" is no subject of glory to the country—a thing unworthy of exciting interest or preferring claims to the sympathy of the nation. This point being once established, let the *real* friends of the drama, instead of levelling their shafts against lessees, and managers, and authors, direct the whole artillery of their indignation against the government and the public. Let them, as their tempers may dispose them, either deplore the disgraceful apathy of Englishmen to so important and brilliant a branch of the literature of the country, or laugh in derision at their want of taste and their excess of stupidity.

We have now taken a survey of the dramatic question at large, and we have pointed out the grand, the vital obstacles that militate against its progress and success. In a future number, we will enter into a more detailed view of the question.

PERTINAX.

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A REPLY

TO THE

LETTER

OF

SIR ROBERT SEPPINGS, KNT. F. R. S.

SURVEYOR OF H. M. NAVY,

ON THE

ROUND BOWS AND CIRCULAR STERNS,

BY

CHARLES EKINS, REAR-ADMIRAL.

LONDON:
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1824.

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A REPLY,

&c. &c.

SIR,

THE very intemperate and ill-judged letter which you have thought proper to publish, addressed to me, may be considered as deserving a very different reply to that which I am about to give it. But I am actuated by two reasons; first, that I trust I could not condescend to retaliate in the same style; and, secondly, that anger is generally considered to be a proof of a weak cause; I therefore could not follow the example you have set me, as I am confident in the strength of mine. Your personal attack could only excite one sensation, I therefore treat that as it deserves; as indeed I should do the whole of such a letter, did I not feel that individually I owe it to my friends, and professionally to the public, to refute the charges you have endeavoured to make against me. My object, therefore, will be to divest myself

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of all personal feeling, and adhere as closely as I can to the public question; and as clearly and concisely as I am able, confine myself to the facts.—I am confident that I shall prove I have in no instance been influenced by partiality or prejudice; indeed, having no knowledge of either yourself, or of Mr. Roberts, but as professional men, I could not have such feelings towards either of you. Here I owe it to myself to declare, that in the work I have written I most cautiously avoided giving cause of offence to any one; and it has been particularly gratifying to me to have been assured by all those I have met with, who have read it, that I have succeeded in my wishes, as no one could with justice complain.

I shall now reply to the subject as it stands in your letter.

With Mr. Roberts I am sorry to say my personal acquaintance is very slight, having very seldom seen him, and, to the best of my recollection, never having spoken to him in my life; yet I shall always be glad to have a man of acknow-

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ledged talents, integrity, and honor, considered as my "Friend."

You say that "nothing would be more agreeable to your feelings, than to see a comparative statement of the two methods fairly, candidly, and accurately laid before the Public, on whose decision you are prepared to abide, without thinking of an appeal to any other tribunal." As nothing appears to be more anxiously desired by Mr. Roberts, why should he not, in common justice and good policy, be allowed a trial with you? It is time to lay aside diagrams and models, for *you* have shown us that they are not to be relied on, having swerved from your originals yourself.—If you give him an opportunity of trying his skill in *building* from his plan, we shall then *see* whether his Sterns deserve to be placed in comparison with yours, or not.—You have had *many* opportunities of trying *yours*; *his* have hitherto cost the country *nothing*; and is he so very undeserving of notice, as not to be allowed *one* trial?—*Bonaparte* would have offered a premium for the *best*, and his country would have benefited by an open

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competition. Three brigs have lately been built upon the plans of three different persons, Professor Inman, Captain Hayes, and I believe yourself: but Mr. Roberts, whose abilities as a shipwright are so well known and appreciated, and who is a builder in one of His Majesty's dock-yards, is not allowed a single opportunity even of proving that ignorance of which you seem to accuse him.

The principal object, I presume, sought for in the brigs, is the *sailing* quality; that in the circular sterns, the *fighting* quality; and allow me to ask which of them is of the greatest importance? In page 4 of your letter to Lord Melville, you say, "a ship of war in times of hostility is, or should be, a floating castle, capable of acting upon the offensive or defensive, as the case might be."—Have your circular sterns yet undergone any trial as *batteries?* Has a *shot* yet been fired at any object from either of them? and what are the reports upon that subject? The shape of the stern above the water will little affect a ship as a sea boat, or prevent her from doubling Cape Horn, or any other place; but what are your sterns as *batteries?* If no experimental proof has yet been

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made, instead of the two wooden guns which are now on board one of the ships at Portsmouth, why should not a sufficient number of guns and proportionate ammunition be put on board, and let her be towed out to St. Helen's, and there anchored for a fair trial? This, I consider, should be a continued cannonading of not less than two hours, at objects placed in every direction around the stern and quarters.

In one of your former letters to me you observe, that "diagrams at best give but a poor explanation, compared to models, which, if properly executed on a large scale, may be considered as a reduced fac simile." But it is now time to try the things *themselves*: when sterns of a novel construction are formed for offensive and defensive purposes, let it be seen and proved that they completely answer the intention. Before a war shall necessarily bring them into use, the British navy should know how far they can be depended upon. In your letter to Lord Melville, page 10, you quote the opinion of an experienced seaman (Captain Larcom), "that the stern of a man-of-war should be constructed like that of a Dutch

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fly-boat; that there should be ports all round, to enable you to fire in every direction, and from all the decks, and that there should be no ornaments, &c." In this opinion you seem entirely to concur; *I* would carry the intention somewhat further, and not only fire in every direction from all the decks, but, if possible, to fire in every direction *at different objects at the same time,* from all the decks. If any of your circular batteries can do this, I shall be most happy so recal every thing I have said to their disadvantage, and to congratulate the country and yourself on the success of your invention. Unless they can do this, they will make little impression on a fleet of gun-boats; and the way to accomplish it is not by contracting, as you have done, the platform for the guns.

You inform us " that the stern of the Prince Regent, from the water's edge to the taffrail, resembles the *form of a cone;* if, therefore, it is good below, it must be so above." In this conclusion we are by no means agreed. The *base* of a cone, for aught I know to the contrary, may not be an improper form for the stern of a ship; but if on mounting the main deck, the quarter deck, and

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the poop, you approach the *vertex*, I am not surprised that Capt. Brenton should have discovered the " melancholy defect," as he most likely could not find sufficient space for the working of the guns intended to be placed on them. The steeple of my little parish-church is a *cone*, but it would be impossible to place any bells at the top whatever may be done at the bottom of it.

I have now to observe that the " *hints*," on which you so frequently attempt to be sarcastic, *did*, nevertheless, originate with *me ;* and it is not the slightest mortification to me to be informed, that Mr. Roberts, in his letter to the Navy Board, did *not* give " the most distant hint " to that effect. On the contrary, I give him credit for too much propriety and good sense to have taken that liberty without my leave : but of his own free-will he had *before* acknowledged to me himself, that he had acted upon them. And what may perhaps surprise you still more, the plans he formed for his bows, whether good or bad, old or new, were submitted to the Navy Board by my advice. To me and to other sea officers they appeared entirely *new*, in the means and mode of arming them ; and as to working the cables on the upper deck of two-decked ships, it

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has been long practised in the American navy, and to them I have understood belongs the merit of its introduction.

I do not think it will "derogate from my dignity one hair's breadth," to confess that I am not skilled in ship-building. Neither do I consider it would have derogated even from *yours*, as a surveyor of the navy, if, upon any plans of public importance being submitted to you for inspection, you had pointed out the errors or defects to the projector, and directed him to reconsider and amend them. The case was very different with the public officer in question; his plans and models appear to have been preserved only to be produced against him at a suitable opportunity. But these, spite of their alleged defects, till you, or some other person will furnish me with better, must still "figure in my Appendix."

Of the mathematical proportions of plans and diagrams so furnished me, I no more considered it my business to examine into, than if I had received them from *you*. And yet I see no impropriety in giving an opinion (such as it is) upon

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the general impression they were calculated to convey.

Of the blunders committed in the construction of ships, no one acquainted with the dock-yards can be ignorant; but that an experienced and skilful shipwright should so contrive the ports, that his guns should explode *inwards*, is indeed a surprising circumstance, and a most serious defect. To the great danger arising from an explosion inwards, must next be considered the evil of taking fire *outwards;* of this there must evidently be considerable risk, from the muzzles of *your* guns, as represented in figures 28, 29, and 30, page 412 of my Appendix.

I must now be allowed to say a few words on the subject of the galleries. In the general construction of the fabric, I have given you credit for greater strength than in the square sterns (see my Appendix, page 415). But to this, the overhanging weight of a stern walk (however light) cannot certainly contribute: in this meaning the term weakness is to be applied. Of its utility I have before given my opinion. Its inconvenience

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will be best judged of by those who will have to remove and replace the railings, &c. for the proposed exercise of the guns.

It once happened to me to check desertion from my ship in the night, by running into the old quarter gallery, on hearing the splashing in the water, as of a man overboard. By firing a pistol in the direction of the gangway, where the noise was heard, the man was recovered, and attempts of that sort put a stop to. It is also obvious that quarter galleries so placed form an excellent flanking position against boarders. I much doubt if any of the galleries as you now place them possess the same advantages.

I now proceed to your charge of unfair dealing. I believe, Sir, you must recollect, that early in November last I made known to you, by letter, my intention of introducing the subject of circular sterns into my "Treatise on Naval Battles," enclosing you a prospectus of it; and requested, that if you thought proper, you would supply me with such plans, or descriptions of your sterns, as you should yourself select, as I had it in contemplation

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to compare them with those of Mr. Roberts, to whom I applied nearly at the same time. It was at that period I first thought of introducing any plans whatever; and, on deciding to do so, I wrote first to Mr. Roberts, to ask if he would have any objection to furnish me with his, not knowing whether he would choose to comply with my request, having no acquaintance with him; and if he should refuse me, as his plans had never been acted upon, I had no means of getting them correct but from himself, and without them I could not of course have put my intention in execution. However, he very civilly complied with my wishes. I then wrote to you, and in my letter I frankly confessed to you that I had already conceived a preference for his, but that I was open to conviction, and ready to acknowledge myself in error, whenever my judgment could be convinced that my opinion was a wrong one. Your letter to me in reply is now before me, dated November 11, in which you not only thank me for my "very obliging communication," but regret that you cannot have a conversation with me on the subject of the alterations in the sterns of the ships of war; but you inclosed me your letter to Lord

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Melville, which you said you supposed me to have been in possession of before; and at length you say, "As the subject you are about to treat of will in all probability occasion me some considerable trouble, and as you state you are in possession of a model of Mr. Roberts's proposition, would it not be well that you should also have one of mine? if so, I will on my return forward one to you from Portsmouth to Plymouth for your inspection, and you can return it by a similar conveyance." On this I wrote to you again, requesting some drawings explanatory of the circular sterns instead of models; and in your answer, dated November 18, from Pembroke, you with equally apparent cordiality and civility said, "on your return to town you would endeavour to comply with my wishes." At the end of ten days I received a third letter, dated London, November 28, as follows:

"Upon further consideration, I think it necessary to decline your very obliging offer to make your publication the medium of an explanation of my principle of constructing the sterns of ships, feeling, that if any vindication of my plan is necessary, I ought in prudence and justice to reserve

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my observations until after you have introduced to the public Mr. Roberts's remarks upon the subject." This naturally surprised me, and I made no other application to you. The first part of my work on Naval Battles was then in the press, and some of the plans of Mr. Roberts were in the hands of the engraver, but I was left to procure yours as I could. In order as much as possible to prevent mistakes, I *cut out* the plans for my purpose from your printed letter to Lord Melville, giving the additional parts in plane and profile, by the dotted lines already accounted for in page 407 of my Appendix. And for the elevation of some of your ships, I immediately wrote to an artist on the spot, desiring him to make me as correct and faithful a drawing of them as possible. Of the ships chosen for the purpose I of course named those I had myself been on board of, and of which I have made some mention in the body of my work.

I now leave it to the public to judge which of us has been the unfair dealer. Disappointed in my expectation from you, I applied to the builder at Chatham dock-yard, who refused me on the plea of your plans *reaching the enemy!*—If the

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specimens I have given are so objectionable to you, the fault cannot be attributed to me, for had you furnished me with those you at first promised me, I should most readily have introduced them.

The charge of finesse and (wilful) misrepresentation in the paltry instances you name, are beneath a serious refutation, for even those "who have no other knowledge of me," will believe me incapable of any thing so contemptible.

You have very justly observed upon the generally defective arrangement of my work, and of my confounding and confusing the subject of the bows and sterns. The first I have apologized for and endeavoured to explain in my Preface; the other faults I am as fully aware of as yourself. They were perhaps in great measure occasioned by the variety of subjects I had necessarily to introduce; and notwithstanding the exertion and attention of my publisher, Mr. Baldwin, yet his having to communicate with a person living at the distance of two hundred miles, it is not to be wondered at that errors and mistakes should have arisen.

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As the rest of your letter is principally a recapitulation of your own services, and an assumption of the ignorance of them on my part, I shall content myself with observing, that if there is at this present time the bow of a first rate, *pierced for* 12 *guns* (fig. 3 Appendix) "proposed by you, adopted many years ago, and now in general practice," I have never seen nor heard of it.

The country (and the Navy in particular) acknowledges your eminent services to it in a great many instances. In your late alterations of the stern of His Majesty's ships, the great benefits to arise from them are considered doubtful; and although you appear to hold me up as singular in my opposition to them, yet here I think I *can* "venture to affirm," that I may have the majority of the profession in my favour.

I must now observe, but as a circumstance of little importance, that your letter, although dated 24th of *June*, did not reach me until the 29th of *July*. I only heard by accident of such a publication, and immediately sent for it.

Whatever impression this reply may be calcu-

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lated to make on your mind, I shall rest satisfied with that which I conceive it will have upon my readers of a less prejudiced and more impartial description.

Convinced that I have not taken any part against you, either "unjustly or unnecessarily," I shall now, Sir, take my final leave of you, for whatever you may think proper hereafter to address to me will remain unnoticed by, Sir, your humble servant,

CHARLES EKINS.

Bishopsteignton, near Chudleigh, Devon,
August 13th, 1824.

C. Baldwin, Printer,
New Bridge-street, London.

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LETTERS

ON

PROFESSIONAL TOPICS;

VIZ.

1.—ON THE DRY ROT IN THE NAVY.

2.—ON THE NECESSITY OF PRACTICE IN THE USE OF SIGNALS AND NAVAL EVOLUTIONS.

3.—ON SUBJECTS CONNECTED WITH SHIP-BUILDING.

BY VICE-ADMIRAL STIRLING.

LONDON:

J. & W. T. CLARKE,

PORTUGAL-STREET, LINCOLN'S-INN.

1825.

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Luke Hansard & Sons,
near Lincoln's-Inn Fields.

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PREFACE.

THE following three Letters have been sent to the Admiralty in the course of the present year; and the subjects on which they treat appear of sufficient importance to justify me in printing them, not with any view to publication, but for private circulation.

The first Letter is on the Dry Rot. I have lately had an opportunity of becoming acquainted with a remarkable instance of the infectious nature of this disease. The Wasp sloop of war was considered perfectly sound when she sailed for Jamaica, but being found to be infected with the dry rot, she was obliged to return home before her station had expired. Some wine-cases which had been in her were placed in a gentleman's cellar, perfectly free from damp, or any kind of rot; but after the introduction of

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these cases, every cork, and every piece of wood in it, might have been crumbled between the fingers, and a variety of fungus spread itself over the walls and door.

I am far from meaning to assert that very great precautions are not used in our dockyards to procure sound timber; all I mean to say is, that from certain causes which I have mentioned, these precautions are often rendered nugatory. Timber measurers generally act upon the supposition that they can ascertain the existence of disease by boring and dubbing the wood in different places; and as long as this superficial test is relied upon, the infection will be propagated in spite of all seasoning and nostrums whatsoever.

The second Letter was intended to draw the attention of their Lordships to the necessity of keeping up and improving the skill of officers in the use of signals and naval evolutions in the time of peace. Perhaps the plan I took the liberty to recommend might be regarded as more adapted for the amusement of youth than the occupation of men

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who have already attained rank and experience; but by a slight additional expense, a squadron of yachts might be formed, which would give weight to the plan, without attracting the notice of those whose watchfulness of the public expenditure might be alarmed at the equipment of larger vessels, for a purpose which they might not be disposed to consider sufficient to warrant such an extraordinary expense. Perhaps no more appropriate time could be selected for such an experiment than the present, when the mania for regattas is so prevalent.

Some good officers in the late war did their duty as youngsters in the fore-top. The refinement of present times would of course render any such method just now totally unpalatable; but as a knowledge of seamanship, and that quickness of sight which is indispensable in situations where the evolutions must be so rapid as to seem almost the effect of volition, instead of the result of combination, can only be acquired by downright practice, something of the sort I have recommended seems to be, to say the least of it, highly desirable.

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The third Letter is a kind of epitome of matters connected with ship-building, which have fallen under my observation during a long professional life, both in the civil and active departments. On this subject much has been said and written, and many experiments are daily going on. I think an attention to first principles might very much simplify it; and I have endeavoured to state what should be the leading objects of the naval architect, and to enforce the necessity of his directing his attention to mathematical exactness, instead of being contented with approximations.

I will make no further preface to my Letters, which I now submit to the consideration of those to whom professional pursuits may render such subjects matter of interest.

Woburn Farm,
1*st October* 1825.

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LETTERS,

&c.

LETTER I.

SIR,

HAVING seen in the newspapers that it is proposed shortly to call the attention of Parliament to the dry rot in the navy, I take the liberty of submitting to their Lordships some observations which have occurred to me on the subject of this alarming evil. The observations have been made during my residence in the country, where my attention has occasionally been drawn to the manner in which timber is felled and taken off the ground; and though I am aware, that as the mere suggestion of an individual they carry but little authority, such, it must be admitted, have sometimes, in similar cases, called the attention of the scientific to the true seat, and subsequently to the remedy of the mischief.

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In the early part of my professional life, the dry rot was not a topic of conversation on the quarter-deck; it was known long before; but as I have not the vanity to suppose that I could give any information by attempting to treat the subject methodically, I will not trouble their Lordships with any account of the first appearance of the disease, or its gradual progress. It is enough to say, that it was for several years in a state of rapid increase, and that all the remedies that have been tried have hitherto proved unavailing, or insufficient.

The infectious power of this disease is prodigious. A single piece of infected timber has corrupted a whole ship, or even a dock-yard, whilst its subtlety is so great, that it will move from one part of a room to another, or even to the opposite side of a street, without there being any possibility of tracing its path.

I do not mean to deny that there may be a variety of causes which would produce the dry rot, or at least some *rot*, which in its effects would be very similar; but the observations I have made lead me to the conclusion, that in almost every case the dry rot is

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produced from the trees being felled after the juices have ceased to circulate; and that when once the timber has received the infection, no nostrum or other means can eradicate it. Palliatives may be used, and timber supposed to be affected may be preserved, and funguses have been sometimes successfully removed; but I could never feel safe with timber where the disease had once been known to exist; nor would I, after any preparation, admit such timber to come in contact with other.

It may be said, that even supposing the above is the origin of the evil, it gives no reason for its increase of late years; but I would submit, that the present practice of timber dealers, is precisely such as to render it impossible to know whether this disease exists in the timber they produce for sale or not. They saw off whatever part appears rotten; and should the root exhibit any symptoms of decay, which is an almost infallible test of the existence of disease, they either grub it up, or remove the trunk from the place of its growth. Thus good judges are often deceived by the external appearance of soundness; and many trees are brought into use which contain infection enough to destroy a

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whole navy. How long this infection may continue latent, depends upon a variety of circumstances and situation. Immersion in salt water has removed fungus, and the timber has appeared sound for years; and burying timber in earth or sand, or paying it with tar, or painting or filling the pores with oil or other correctives, may do much to keep it down for a time; or there may be advantages or disadvantages in felling timber in spring or autumn, or at any particular time of the moon's age, or when the wind is north or south; or thorough seasoning may prevent the fermentation of the sap; but I repeat, that where the infection has once existed, there must always be danger of the disease breaking out.

It is the practice of the timber dealers, which I have before alluded to, together with a want of due caution on the part of those who are commissioned to purchase, that in all probability has most materially contributed to the increase of the dry rot in the navy. Other causes may assist to produce it, or at least something very like it; and it has been said that no inconsiderable one is the mode adopted about thirty years ago of filling and

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caulking to the floor-heads, to guard against springing a leak when a ship has taken the ground. A free circulation of air is certainly thereby prevented, and when this is the case, decay must be expected to follow. Whether this decay so produced, be actually the disease of the dry rot, I cannot take upon myself to say. The evil is in both cases the same, but the prevention of the one, is certainly more easily effected than the other,—proper seasoning, with a free circulation of air afterwards, being always sufficient to check the progress of a common rot.

It is well known, that the increased demand for timber, together with the great increase of price, has brought a great deal of oak into the market, which formerly would have been looked upon as unfit for sale. I do not now know the quantity consumed in this country; but during my professional life, when it was my favourite amusement to inquire into every thing connected with shipping, I have understood that 50,000 loads of English oak, with about 10,000 of foreign timber and plank, was the amount of the annual consumption in the King's yards. Besides this there was the quantity used on shore, with the amount of

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which I am not acquainted. The purveyors, I have also understood, were in the habit of making their purchases from lots of timber exposed for sale, or collecting what was wanted from the Royal Forests, either by taking trees as they stood, or when they were separated from their roots. Either of these methods, I conceive, lead to the evil I have before mentioned, viz. that of buying timber in such a state as to render it impossible to know whether there is latent infection in it or not. With great deference I submit therefore, that no timber, either English or foreign, should in future be brought into the King's yards without the body of the tree is brought entire, with the root attached to it, or having undergone a previous inspection by some competent officer, as well with regard to its soundness, as to the nature of the soil in which it was grown. This I apprehend to be the only criterion, by which a competent judgment can be formed of the soundness of timber; and till this is adopted, I should even doubt the unexceptionable efficacy of all the caution which is now used in our dock-yards, of building and repairing ships under ~~order~~ cover, and the, in many respects, admirable method for

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thoroughly seasoning timber by stacking it in piles.

The method I have ventured to suggest would perhaps be impracticable for the whole quantity used in this country, but not so for the comparatively small portion used in the King's yards. It will certainly cause additional expense, and it will interfere with the profits of the timber dealers; but I am satisfied that the benefit which will thereby arise to the public service will be very great; and having this persuasion in view, I trust I shall be excused for having detailed my opinion at so much length to their Lordships.

I have the honour to be,
With great respect,
Sir,
Your most obedient servant,

CHARLES STIRLING.

J. W. Croker, Esq. Secretary,
Admiralty.

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LETTER II.

SIR,

AS I think it the duty of a naval officer to submit to their Lordships whatever he considers conducive to the advancement of the service, I take leave to offer some remarks on what I conceive to be a very important subject; and if such remarks have not the merit of novelty to recommend them, I trust at least that they will not be considered as intrusive.

The great superiority which the British navy has evinced in the late wars gives us strong grounds to hope that this happy nation will retain the ascendancy it has acquired; but as other maritime powers will naturally be envious of such superiority, their aim, in the event of a future war, will probably be to adopt some mode of fighting with which it may require habitual practice in tactics to enable our officers to cope. Unquestionably our seamen have proved themselves in practice the best in the world; but, from what

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I attribute to a deficiency in naval science, it has happened on several occasions that an enemy's fleet has, by certain manœuvres, prevented our closing, and thereby avoided a general action.

In the war with France, which began in 1778, it must be in the recollection of those who served at that time, how little skilled we were in naval evolutions. Even in later times, notwithstanding the glorious achievements of our navy, superior officers have often been compelled to be dependent on their inferiors for expertness in signals; and, consequently, many mistakes have been committed when an admiral has attempted to exercise his fleet. The treatise on naval tactics by Mr. Clark did much good; and the code of signals promulgated by the Admiralty about 1799, with plates and explanations, was highly useful; but the benefit to be derived from such a system will make but slow progress in the time of peace, unless there are sufficient opportunities afforded of blending practice with theory. I therefore with great deference suggest, whether it might not be desirable to form a squadron of small craft, for exercising officers in the use of signals,

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and naval evolutions in general. Undoubtedly a squadron of ships at sea would be the best adapted for such a service; but as this might be looked on as too expensive, I presume that a small squadron, consisting of ten first-rate launches, lengthened to fifty feet, and rigged as ships, might be advantageously employed for these purposes, at Spithead or the Nore, when wind and weather would permit. These vessels would only require four competent seamen to take care of them, and when under weigh, the number requisite to work them might be made up with midshipmen and youngsters. The rigging might be taken from old stores, fitted and placed over head by boys. I have not calculated what the expense of such an equipment would be, but I fancy very trifling, and the advantages that might be derived therefrom would, in my opinion, be very considerable. Officers have often sent their sons to sea in the East Country Trade, or in West Indiamen, under the idea of their learning seamanship with more facility than the navy affords in peace time; but by means of this little squadron many things connected with a seaman's business can be practised with effect, whilst the

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mind would be gradually habituated to the larger and more complicated operations of a fleet.

There is an old saying, purporting that the signals for the line of battle, and to engage, are the only signals for a fighting man. Lord Nelson used to say, that if an officer lays his enemy on board he cannot be far from right. Sayings like these do very well on proper occasions, but we well know they sometimes are out of place; and mere fighting does not comprise the whole services required from an officer. He should be prepared for other operations, and more intricate evolutions, and a knowledge of these may be very considerably promoted by keeping such a squadron as I have recommended continually employed, either in taking up different positions, or in adopting various modes of defence and attack; in bringing up against batteries; and in presenting a collected force to a given point.

Should this plan be approved by their Lordships, it might be thought proper that each of these vessels should be commanded by a candidate for a lieutenancy before he receives confirmation; and each division, as

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well as the squadron itself, might be commanded by a captain applying for employment. The time of command might be limited according to the skill shown by the respective commanders. This would brush up latent talent, and not only draw more general attention to signals, but be a certain way of ascertaining the real qualifications of each person in the squadron.

This plan will probably be thought of more importance, if it is recollected, that Frederick the Great encouraged the invention of a game, by the professor of mathematics at Brunswick, by which he convinced the general officers, whom he assembled together at Potsdam, of the effects of the loss of the battle of Maxen. The same professor afterwards proposed to form a game applicable to naval tactics, but he died before sufficient progress was made to show the efficacy of his plan. Perhaps something of this sort would be useful to our naval youth, with the addition of lectures on mechanics and ship-building, besides the course of mathematics and navigation usually taught.

I have of course heard of the line of education followed by the professors of the college

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at Portsmouth, and of the increasing number of schoolmasters afloat. I likewise hear of the examinations touching certain points which young men must undergo before they pass for lieutenants; but still I think that a mere theoretical course is not sufficient. All the reading in the world will not make a seaman; and the most accomplished theorist might on some occasions find himself sadly at a loss on the quarter deck, when a moment might decide the fate of a battle.

The navy of Great Britain certainly deserves every encouragement of which it is susceptible, from the laying of a keel to the highest finish of a line-of-battle ship. In a former letter I took the liberty of submitting to their Lordships what appeared to me the only method of ascertaining whether timber was sound before it was converted to use, together with the necessity of allowing openings for a free circulation of air between every timber after it is placed in the frame, from the limbers to the plank sheer, as well as through every other accessible part of the hull. I know this latter plan will interfere with the compactness as well as the strength of a ship; but no evil can be so great as the

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dry rot; and every thing should be sacrificed for its prevention. With proper precaution, however, I see no reason why this formidable disease should not be kept from the navy, and ships restored to their former durability of fifteen years at an average, and even longer, without wanting any material repair.

I have the honour to be,

Sir,

Your most obedient servant,

CHARLES STIRLING.

J. W. Croker, Esq. Secretary,
Admiralty.

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LETTER III.

SIR,

THE experiments lately made to improve the rate of sailing having engaged much attention, I trust I shall be excused in offering some observations to their Lordships on the subject. Ship-building was always a favourite study with me, and though many years have elapsed since I visited a mould-loft, I learn from various sources sufficient of the progress of naval architecture to supply the deficiency of actual observation.

The great improvements which have of late years been introduced into every branch of the naval department are unquestionable, and nothing seems wanting to fix these improvements but a due consideration of the mathematical principles with which they are connected, and the selection of some particular class of ship of each rate, into which they shall be introduced, and their united efforts experienced. Hitherto there have been no fixed or positive principles in naval archi-

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tecture established by demonstration, and confirmed by use; nor is there a rule sanctioned by common consent, but the artist is left to the exercise of his own judgment; and therefore it is less a subject of surprize than regret that the best shape for the body of a ship has never yet been ascertained. It is likewise a desideratum, that when the draught of a ship is planned, there should be some guide laid down for the seaman, by which such an arrangement of the stowage of the hold may be made, as would present the most favourable lines to the fluid; and by which also the motive power would be directed to the point where it would operate with the best possible effect. For a ship, it must be recollected, is destined to move in two fluids, water and air; if therefore it was established what is the best form for overcoming the tenacity and resistance of the former, great judgment would still be necessary to determine the precise place where the propelling power of the latter is to be applied.

The received theory of the resistance of fluids, as well as some experiments made to ascertain the most proper angle for overcoming such resistance, have misled many constructors.

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The error arises from the very slight knowledge we possess of the laws by which water agitated acts upon bodies that float therein, and the resistance which bodies meet in passing through water. We even remark, that when a vessel is lifted up by the waves, it rises by an accelerated motion, and falls by a retarded one, which appears directly opposite to those opinions that we commonly form upon the action of water; and therefore it is very probable that many advantages in ship-building arise from causes which are not accounted for; and that instinct frequently directs us to judge of several mechanical effects without understanding their principles. It would however be desirable, that in the adaptation of a ship to the services for which she is designed, there should be nothing left undetermined and arbitrary. The naval architect should not only possess a thorough knowledge of science, but have the benefit of the experience acquired by the seaman, and the seaman should have all the aid which the scientific artist can afford.

To construct a ship likely to answer the most desirable purposes many contradictory powers must necessarily be blended together,

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and of course great difficulties will occur; no other machine requires so much consideration. Not only regard must be had to the arrangement of its parts, and the obstacles and various casualties it may meet with, but the various purposes, for which it is destined, must be taken into consideration, and suitably provided for.

I have not the vanity to suppose that I could offer a plan likely to improve the art of ship-building. Retired, indeed, as I have been for years from my profession, I might feel some difficulty even in projecting the draught of a ship. I am little inclined therefore to propose any novelty. I am on the contrary so thoroughly convinced of the superior qualities of the class of seventy-four gun ships, of 1,730 tons, which are now almost exploded, that I do not think they are likely to be excelled. Those ships carried their ports sufficiently high, and stood well under their canvas; they carried a good helm, and worked well, with much less wear and tear, than long-legged ships, and were good roadsters. I have known excellent seamen prefer such ships to those of larger dimensions, on two decks; and they would, I have no doubt, on most occasions,

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have many advantages when well handled. As I believe there are many people who differ with me on this part of the subject, I offer my opinion with great deference. Large ships, it is maintained, are absolutely necessary in the present state of foreign maritime affairs, and the notion has been countenanced by authority. I shall take good care therefore, that in the observations I am now about to offer to their Lordships, none are advanced but such as are the result of experience and reflection.

The perfection of every kind of ship may be comprised in the three qualities, burthen, stability, and swiftness; and upon these three naturally depend all the secondary qualities.

Of the different classes of ships built upon similar principles, the largest is the most eligible; and the reason is evident. The ship whose top-side is the shallowest in proportion to her capacity under water, possesses two of the most essential qualities in a line-of-battle ship. She will stand well under her canvas, and will hold a good wind; whereas we have seen the defects of instability, and being leewardly when under little sail, very common in our navy.

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Our first rates of the largest class are certainly very excellent ships; and notwithstanding some inconveniences from their size, their good qualities are principally dependent on their great capacity. If we examine our smaller first rates, which were formerly called ninety-gun ships, we shall find that they are very disproportioned, and have all the vices of construction which lead to the defect of instability, without that compensation of great capacity which the larger ships possess, and which is the chief corrective against instability in three-deckers, where the centre of gravity is necessarily very high, and the form little calculated to derive lateral support from the fluid.

Of the ships that carry their guns upon one deck, the frigate of thirty-eight guns is, I think, the best; of those that carry them on two decks, the seventy-four. In comparison with the difference of their dimensions these ships require little more top-side than the smaller rates; that is to say, a thirty-eight, and a seventy-four-gun ship can be brought down to nearly six tenths of the height of the top breadth, which is allowed to be the best sailing trim for ships in general,

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if their bodies are constructed suitable thereto, whilst the proportion of height for the top breadth is one fifth of the length of the gun-deck.

The seventy-four-gun ship, constructed with due regard to proportion, and other obvious qualities, and properly masted, may be considered as uniting the properties of the first rate and the frigate. She will not decline an encounter with a larger ship on account of superior weight of metal, nor abandon the chase of a frigate from a defect of swiftness. The union of these qualities has given the seventy-four a distinguished pre-eminence in the line of battle, and ought to make her the principal object of maritime attention.

Of late years two-deckers have been built on such a large scale that it may be feared lest we should lose the benefit of the seventy-four-gun ship altogether. The Sans Pareil was the favourite ship of her day. She carried eighty-four guns, and was fifty-four feet and a half beam, and one hundred and ninety-three feet gun-deck, and of the burthen of 2,245 tons; but she was unweildy. She hung heavy on her rigging, and her wear and tear was very great. The Americans have two-

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decked ships that carry one hundred and ten guns, and are fifty-six feet beam, and two hundred and fifty feet gun-deck; but the probability is that such ships, and all ships which exceed a given limit, will be found deficient in some essential qualities. They present, indeed, an imposing battery, but leave the seventy-fours of 1,730 tons unrivalled in compactness and general utility.

In constructing a ship the services for which she is intended should be considered. A ship destined to navigate the ocean will require her floor to be formed with more rising than if she was designed to sail in shoal water; and if she is meant for burthen she should have a flatter floor, and more capacious midship-bend than would be advisable with reference to her capacity as a ship of war. A large vessel can better dispense with breadth, in proportion to the length and depth, and the smaller she is, the more breadth is required, to make her carry a sufficient quantity of canvas. I will not, however, offer an opinion on what kind of vessel may be requisite to meet particular services; I will only repeat, that whilst so many attempts to combine the various desirable qualities have

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failed, we still have in the seventy-four, to which I have before alluded, a standard for imitation, which unites more excellences than any other class of ships I have yet seen. I am fully aware, that two ships built from the same lines very often differ materially as much from the original intention of the artist as from one another. It is not necessary, however, to dilate on evils which have caused much disappointment in the navy, and especially as the science of mathematics affords the means of avoiding similar errors, by enabling artists to calculate, with sufficient precision, what quantity of water any body will displace; but I must observe, that there is less danger to be apprehended from copying even a defective plan, than from making a new projection, which may please the eye, without accurately ascertaining what effect the alteration may produce.

In forming the horizontal sections it will be necessary to make the plane of flotation very full, because it will make a proportionate reduction at the extremities, and thereby preserve the requisites of stability and capacity. The water-lines should be made perfectly ~~free~~, fair, without any hollow, giving to the body more

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buoyancy, and being more favourable to velocity; the fore-body, moreover, should be duly proportionate to the aft-body. These are points on which there is but little difference of opinion, but few artists are agreed as to the station of the midship-bend. The usual method was to have it one twelfth the length of the water-line before the middle of the ship, when the beam-moulded was seven twenty-fifths of the length of the gun-deck; but if the ship has a greater proportionate length, her evolutions will be slower, and therefore the midship-bend should be farther forward, to give greater length to the lever, where the force of the rudder is to be applied. The idea that ships ought immediately to taper, or decrease in width from the midship-bend, that the closing of the water abaft may push them forward, and that the shape of fishes ought to be copied in ships, has occasioned many errors in naval architecture, as the analogy does not hold good. It is better to have some of the midship frames continued of an equal area; the ships would then pitch less, from having more bearing in the middle.

The form given to the midship-bend must always be limited between the square and

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the triangle, and therefore the frame will be either nearly a parabola, a semi-circle, or the two segments of a circle. I have never seen but one exception to this, which was a vessel built by Earl Stanhope in 1792, which had her bottom the frustrum of a triangle. This vessel was propelled by steam, and had two masts, that she might sail occasionally.

As a ship when properly laden resists the effort of her sails in proportion to the excess of her lee immerged part, over her weather immerged part, it is generally thought preferable that the futtock should form the segment of a parabola, and that the extreme breadth should be placed near the lower ~~side~~ sill of the midship-port in line-of-battle ships, and at a proportionate height in frigates. When a ship, for instance, lays along, the weather-side will lose much of its breadth, whereas on the contrary the lee-side will gain considerably. The ship thus displaces a great deal more water on the lee-side, and, according to the manner in which fluids act, will be supported with greater force, and consequently be able to carry more sail. Hence, it appears, that by giving the ship sufficient capacity, and full dimensions near the line of flotation, by

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raising the extreme breadth amidships, by having it still higher abaft, and more forwards, the ship will have more stability, and make more resistance to a rolling motion, as being less liable to strain in bad weather. Besides, a ship that is stiff from construction is much better adapted for sailing fast than one which is obliged to be loaded with a greater weight, in order to make her able to carry the same stress of sail.

A great part of the expense incurred by the loss of masts and straining of rigging might have been saved, if a proper form was given to ships bottoms to resist lurching deep, and if the upper works were so formed as to bring the metacenter high upon the mast.

The make of the stem and stern-posts seem quite unlimited; some artists give the stem an agreable curve, and make the stern-post one inch to a foot, whilst others make the ship flare forward and aft, according to their opinions respecting the advantages of full harpings, or of a projecting stem, favouring the passage of the water under the bottom, and of the different pressure of the water on the hinder parts, being more or less favourable according to the form of the aft-body.

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Our ships formerly, and particularly the larger rates, had a great tumbling home in the top-side, but when an alteration was thought necessary, some ships had no hollow; and as we then began to increase the top-hamper we found that the tendency to heel did increase considerably. Our small ships were always over-timbered in comparison with the larger ships; and I believe most ships are too much overloaded with timber, which must be a considerable cause of retardation. At the same time it should be recollected, that sufficient solidity ought to be given to those parts that receive immediate and violent action from the motive or other power, while the rest of the strength is equally diffused through the whole ship; provided always, that no supposed advantage is allowed to interfere with a thorough circulation of air between all the timbers, from the kelson to the plank sheer, as well as through every other accessible part in the ship.

Some ships built on former plans have not been able to keep the sea without an alteration in the original stowage, whilst there has been in some cases a necessity for lengthening

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or shortening the masts of others, and of altering the steps to produce an increase of speed. Such inconveniences must indeed be ever expected to arise when the centre of gravity is too high, or too low, or when the ballast is spread too much fore and aft, and more particularly when the proper place has not been assigned for the motive power to operate with the greatest advantage. The art of stowing the hold has been brought to great perfection, so far as convenience is concerned; and improvements have been made in neatness and utility aloft, but a more scientific method might still be adopted, by which all uncertainty would be avoided.

The above observations it will be observed, relate almost entirely to the hull. The next subject for consideration is the situation of the motive power, because if this is not correct, a ship, however well constructed, will be found deficient as a good sailer. The proper height for masts is still a problem which remains to be solved. Builders give certain rules respecting them, but as those rules are much the same for each class, however differently the ship m y be constructed, they cannot be

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grounded on true principles. If our large ships are properly masted, the smaller ones cannot be so likewise, and the rules will be still more erroneous when applied to ships that have a greater proportionate length to their breadth than the seventy-four, which was the best proportioned ship when the rules were framed.

A long ship has a less tendency to turn on her axis in a longitudinal direction than a short and broad vessel, and consequently the former should always have taller masts, and shorter yards in proportion than the other. We see this exemplified in our smuggling vessels, and some others, which are planned and worked by skilful seamen, whose every energy is exerted to make their vessels sail well. Almost every coast has its peculiar builth, and rig, according to circumstances, but yet the qualities which render their craft most useful are principally dependent on the masting. The Chatham of fifty guns offers a remarkable instance. This ship was constructed with lines the very reverse of those which have been looked upon as essential to velocity, and certainly nothing could sail

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worse, either by or large, until the main-stay was carried away in chase, when such improvement in her sailing was observed, that on going into port, the main-step was moved forward, and the mast was allowed to have the greatest rake aft I ever saw. The centre of effort of her sails being thus removed, the Chatham, without other known alterations, or any attention to trim, became the swiftest and most weatherly ship on the coast of America in 1781. The mere raking of masts however, with all the exertions of good officers, has not always produced similar effects on other occasions. We have seen new and old ships, and ships that were built with great solidity, and others made as elastic as possible, sail well at one time and very bad at another time, and this when in the same hands. It would hence appear, that notwithstanding a vessel may be well constructed for moving through the water with the least resistance, and also may possess every other desirable quality, all may be rendered vain by the motive power not being applied to the proper point. This point can only be when the centre of effort of the sails coincides with the

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centre of resistance of the vessel, and at such height as may not depress the bow, or lift it out of the water, so as to interfere with the most favourable lines being presented to the fluid.

Should it be thought proper to give this subject due attention, it will be found that a reduction of the number of classes in each rate, as well as the overgrown size of some of them, will be attended with considerable reduction of the expense of stores; and if such is the fact, it is an object of great importance. There were formerly what were called Establishments in our naval yards, which became of little use when permission was given to change masts, yards, sails and ropes, at pleasure. Perhaps an Establishment could not now be strictly adhered to when there are so many classes of ships in each rate. But I am apprehensive that without some very material alteration does take place, our foreign yards can never be made able to meet the demand which may be expected in a future war.

I must apologize for the length of this letter, but I could not compress the subject in less space; and having understood that new

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projects respecting ship-building are before their Lordships, I trust that what I have written will not be considered as ill-timed.

I have the honour to be,

Sir,

Your most obedient servant,

CHARLES STIRLING.

J. W. Croker, Esq. Secretary,
Admiralty.

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APPENDIX.

IN the foregoing letters I was of course desirous to be as concise as possible, but in their present form there can be no objection to my making a few additional observations.

In addition to what I stated in my second letter respecting the points about which a small experimental squadron might be employed, the attention of the officers might be drawn to obviate the difficulties that are often experienced, when it has been required to heave down a ship, and adequate means are not immediately at hand. Some practice in the discovery and use of expedients for this purpose might, in a case of emergency, render that an easy matter which has sometimes puzzled even an experienced officer. Another point to which notice might be directed is the knack of cutting and making sails. At present this forms but little part of an officer's attainments, but the esprit de corps which might be expected from a squadron formed expressly for general improvement, might include this amongst other subjects for practice and em-

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ployment. Its importance cannot be questioned when we consider the great effect which the proper make of sails has on the velocity of a vessel. At present, in this department, as well as some others of importance, we are more indebted to accident than rule for any excellence. This cannot be better exemplified than by the jib and fore and aft mainsail, and the lugs of different vessels, which we frequently see set well, although they are cut differently, and roped in a different manner, according to the fancy or ingenuity of the sail-maker.

In my third letter I have not said so much on the enormous size to which some two-decked ships are carried as the subject seems to deserve. It is true, that we have seen foreign ships of this description possessing advantages which are worthy of imitation; but I would submit that these advantages are not necessarily dependent on size, but might be secured without the accompaniment of the manifold inconveniences to which very long-legged ships are exposed. The superiority in weight of metal must be admitted; but a British man of war ought not to lay along side of an enemy as she would be placed against a battery. Good management may compensate, in a handy ship, for any defect in the weight of her cannon. Improvements in sponging, loading, and running out guns, would enable our marine artillery to fire with such additional quickness, as to render our present

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weight of metal fully adequate to any sea-fight. Formerly we had ships that were insignificant in the line of battle, and even some that would not bear a lower-deck port open, when others have been carrying their guns run out; but inconvenient as it was, it does not impose upon us the necessity of running into the opposite extreme. Public attention has of late years been much drawn to steam-vessels, in which the centre of resistance seems to be a great object of consideration. The French term the point to which the power to give progressive motion is to be applied, the centre velique, which, though an expression full of meaning, does not admit of a literal translation. Where this point actually lies, forms a complicated question of hydrodynamics, and requires a knowledge of high mathematics to solve. It has been much the custom, in a very extended practice, to consider that the best point for applying the force of a steam-engine is about one eighth of the vessel's length before the middle line, whilst some engineers prefer the middle of the vessel. It would be very extraordinary that there should be such a wide difference of opinion on points like these, which seem to admit of speedy and practical demonstration, if we did not know the contrariety that exists on subjects apparently still less complicated. The French philosophers, who have principally contributed by their labours to a scientific know-

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ledge of naval architecture, are at issue on several points of great importance. Mons. Bouguer, for instance, recommends that in frigates, when velocity is expected, the extreme breadth should be abaft the middle line. Mons. l'Abbe Bossut asserts that friction has not any sensible effect in retarding the velocity of a body moving in a fluid. Mons. de Romme made several experiments to determine whether the obtuse or the acute end of a block meets with the greatest resistance in its passage through water, and decided in favour of the former. Mr. Chapman, a Swede, made a set of similar experiments, and he was of the same opinion. Some writers intending to corroborate the opinions respecting the advantage of a bluff over a sharp extreme, introduce the custom of seamen towing the butt-end of a spar foremost; but they do not recollect that seamen follow this method because the spar is more subject to sheer with the small than with the large end forwards. The real fact is, that the experiments on which these gentlemen formed their opinions, were not sufficiently accurate. I imagine errors often arise from the want of practical knowledge, when the learned write on nautical subjects, or when they depend on experiments made on a scale not sufficiently large. It is a great misfortune when the celebrity of such names as I have mentioned lead others to adopt their sentiments without due inquiry. Nothing can be more

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vague than Mons. Duhamel's proposal to ascertain the most proper angle for dividing the fluid when forming a ship's bows, to which I have before alluded. The present age has been taught by experience that the midship-frame should be farther forward than recommended by Mons. Bouguer. Mons. l'Abbe Bossut's assertion respecting friction is contradicted by daily observation. And it has been accurately ascertained, that when a triangular body was confined to move in a straight line, it went with its vertex foremost with much more speed than when the other end was forward; the difference was as five to three.

I subjoin some calculations made from the draught of the Robust of seventy-four guns:

	Ft.	In.
The centre of effort of her sails is situated above the middle of her upper deck - - -	84	–
And before the middle of the ship	18	–
The centre of gravity above the line of flotation - - -	2	–
The centre of gravity before the middle line - - - -	3	–
Height of metacenter above the line of flotation - - -	6	2
Height of the centre of the immersed part, or rather the centre of the hollow, taken from the limber strake - - -	9	4

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I do not think the calculations perfectly correct, but they will give an idea to those who are not conversant with the subject, of the various calculations to which I have alluded as necessary to be made with precision in the planning of a vessel. The Robust was a small ship of her class for the present day, being only 1,624 tons. She did not carry her ports high enough, but she was handy, and a good sea-boat. She was not a fast sailer, as might be suspected from the situation of the motive power, nor was she sufficiently stiff. The latter I attribute entirely to her proportions; for whenever a vessel receives an inclination from her state of equilibrium, the centre of the hollow will be removed to the depressed part, and the line of support will be through this point. So long as this line, therefore, passes outside the centre of gravity, the ship will be supported, but otherwise she will overset; and this will likewise be the case whenever the centre of gravity is raised above the metacentre, or as the name implies, the changing centre.

I have not touched on the business of the shipwright in putting the frame together, except only where it appeared necessary to make due allowance for a free circulation of air; but as long ships are apt to break their sheer, there should be additional attention to the shift of the planks, as well inside as outside; and especially the strakes above and

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below the ports should be shifted as clean as possible of the outside strakes. Planking is a very material branch in ship-building, and requires great care in the joining and proper shifting, fastening and caulking. The Robust during the American war had nearly foundered from two butts meeting between two timbers, which caused an opening for the water, when the oakum worked out. The longer the planks are worked, the stronger must the work be; but it would be imprudent to work longer than the usual length of the plank, from the inconvenience that might arise when the ship wanted repairs.

It is much to be wished, that with the different improvements said to be under consideration, some method could be devised, which, at the same time that it might qualify the oxidation of the copper, would prevent the adhesion of weeds and barnacles to ships bottoms. An eminent chemist has recommended the application of pieces of cast iron, which, by a galvanic influence, should protect the whole body of the copper. Something of this kind is certainly much wanted, for the accumulation of foul bottoms is so great, that for many years the application of copper sheathing is completely neutralized. Perhaps an examination into the purity of the copper before it is received into the dock-yards would be of equal utility with the examination of new-fallen timber, as the most certain means of preventing the dry rot.

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Improvements are likewise highly desirable in the manner of suspending the mariner's compass; and in the system of pullies to reduce friction. The substitution of an effectual rudder has not yet been brought to the perfection it is capable of; and they who have seen a lower mast carried away in a gale of wind, will appreciate the ingenuity of Mr. John Weekes, of Chatham yard, who recommends the channels to be so secured as to hold the dead-eyes in their places, and thereby enable men to get at the laniards of the shrouds to disentangle the wreck. The construction of the capstan, with respect to the application of its mechanical power, requires to be simplified, and might be made useful for pumping a ship, as well as many other purposes.

With these observations I will close; and I only wish I had influence enough to bring them under the consideration of those who have the power of drawing proper attention to the subjects on which I have written.

Luke Hansard & Sons,
near Lincoln's Inn-Fields.

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LETTER IV.

Woburn Farm, Chertsey, 9th October, 1826.

SIR,

IN the course of last year, I did myself the honour of addressing to you three letters on Professional Topics, and I now venture to submit a few additional observations on the same subjects. My opinions, perhaps, are not of much intrinsic value; but where the object is of such importance, I feel great satisfaction in contributing my mite to the general stock of information.

It does not appear, that writers are at all agreed as to the nature of the disease in Timber, commonly called the *dry rot*. The most prevailing opinion I believe is, that it proceeds from the

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fermentation, or decomposition of the vegetable substance: that it commences on the surface of the wood: and that it is invariably caused by, or accompanied with, the presence of fungus. If this were correct, external means might cure or prevent the disease, yet we find, that its approach is frequently secret, and unmarked by any outward token which may give warning of its presence, and its cure totally impracticable.

There are two varieties of Fungus which are well known in this country, and from their effect upon Timber, have been quaintly termed *dry rot.*

The former is called in scientific language, *xylostrama gigenteum*, being a vegetable that attaches itself to Oak; and the latter *boletus lacrymans*, that attaches itself to Fir. They possess silky filements, which penetrate into the very substance of the wood, and entirely destroy its texture. The turpentine is completely dried up, and the Fir appears, as if it had been exposed to fire; oftentimes as dry and light as powder, and not unlike the substance we call touch-wood.

So far, I confess, the effect of those fungi is the same as the dry rot, but timely precaution may prevent this effect: the fungi may be removed, and no evil consequences ensue; — whereas, that

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disease which has committed such alarming ravages among our shipping, appears to me, to proceed from an internal cause: is frequently attended by no external symptoms; and from the first moment of its taking effect, is incurable.

When I commanded the Unicorn in 1786, I was ordered home from Antigua, in consequence of the ship being rotten. When we arrived at Deptford, she was found to be so bad, that the Officers of the Yard expressed their surprise that she swam to England. During my command at the Cape of Good Hope in 1808, I ordered a line of-battle ship home, in consequence of her being in a similar state. Now, in neither of these cases, was there any fungus, or any appearance of vegetation, nor the fœdid smell, which is generally observed in pent-up places, where rot exists, yet the timber was in a complete state of decay. I was not aware at the time, that the disease was what is now called the *dry rot*, but its ravages in shipping and in buildings, had been known under various names for many years.

I understand that two ships were built by the India Company, some short time ago, on adjoining slips, and the timber for both was taken from the same pile. One of these ships was found to

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be completely rotten, and the other perfectly sound. I take this circumstance, to be a tolerable good proof, that the disease was not formed after the wood was stacked, but existed previously in some individual pieces. The wood being properly stacked, and exposed to a thorough circulation of air, the disease remained latent, and did not extend to the uninfected pieces; but when worked up, and confined, or exposed to heat or damp, it became alive, and spread like wild-fire. This I apprehend to have been the case with the ship that was so soon discovered to be decayed; whilst the other, being built of that part of the pile which was brought sound into the yard, and from the precautions taken, had not yet become infected, escaped the evil. Had she remained long by the side of the other, the disease would undoubtedly have spread to her, for even Teak, or any wood, however hard, or however well seasoned, cannot resist the infection.

It is much to be wished, that men of science, had expressly defined, or described the dry rot. From the want of such a definition, we are led into a confusion of terms, and have given to many diseases of timber, a name which is not applicable to them. There is one sort of rot, con-

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stantly under observation, and with which new ships, as well as ships that have undergone repair, are frequently found to be infected. It proceeds sometimes from an exuberance of sap, sometimes from other causes; but it is distinguished from the dry rot, principally by this result, that in the former, if the decayed parts are taken out, the disease is gone, and the ship is fit for service; but in the latter case, I should as soon expect to see life restored to a dead body, as a cure effected, where the dry rot has once made its appearance.

During the late felling season, I saw a number of Oak trees thrown down, which some purveyor had bought. Three of these trees were separated from their roots, which on inspection I found to be defective. Some days after, these roots were grubbed up, and removed, preparatory to the timber being examined by an inspector, whilst the other trees remained in the same state along-side their roots. The inference I drew from this is obvious, and though I do not mean to say, that examination of the roots should be the only precaution taken in the purchase of timber, because attention should likewise be paid to the soil and climate in which it had been grown, its exposure to the sun and wind, and other minor

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considerations, it is undoubtedly an essential one, and without which, all the usual tests may prove insufficient. I am far from decrying the great care, that is commonly taken to ascertain the soundness of timber, after it is brought into the dock-yard. The pieces are tasted, and examined in a variety of ways. None is esteemed sound, where there is an appearance of injury from lopping, or where there appears yellow or black spots, these arising from the badness of the soil in which the tree had been grown, and being considered sure fore-runners of decay. It is easily ascertained whether timber has the heart-shake, or the cup-shake, and the terms *foxy*, *doaty*, and *quaggy*, describe symptoms which are well known. It is also observed, whether the albernum is covered with that layer of wood called a vein, the detrimental quality of which has long been ascertained. In Oak timber, the gravity of the wood and its colour, which ought to be a pale yellow about the heart, gradually decreasing in brightness, till it approaches the white wood, together with the smallness of its pores, and the closeness of its texture, are also objects of attention. All these symptoms and appearances, I have no doubt are duly considered; yet from rea-

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sons I have before suggested, though necessary in themselves, they are all insufficient to ascertain the existence of the dry rot. This fatal disease may lie in an incipientstate, as in the pile before mentioned, and not be observable until too late to check its progress.

It is well known, from what parts of the world the most durable timber can be collected; but a sufficient quantity cannot always be procured to meet the demand. It is too often the custom to put different kinds of timber in the same ship, and thus the bad infects the good. The Oak from Canada, seldom remains sound for six Years, and always injures the other timber with which it comes into contact. I do not know whether the mixture can always be avoided, in time of war, but if the precautions I took the liberty in my former letters to suggest, were invariably adopted, some bad consequences would be obviated. And it is only from reflecting how very easily, in my humble opinion, such precautions might be effected, that I am induced to offer the subject again for their Lordships' consideration.

The progressive improvement in propelling vessels by steam, is likely to alter the system of naval warfare, as well as to interfere with our

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nursery for seamen. From the necessarily small number of ships employed in peace, a great diminution of nautical skill must take place, and I apprehend that on the breaking out of a war, that diminution would be sensibly felt. Our seafaring men are not so fond of serving on board a man-of-war as in former times, and as from the difficulty that may be expected to obtain them, more landsmen must of course be employed, it will be found, that more skill in the mechanical duties afloat, will be necessary for officers to possess. I know of no method so likely to make men of rank and education acquire this skill, which has sometimes been found much wanted, as some plan similar to what I suggested in my second letter. We see gentlemen who have not been trained to the sea, manage yachts well; and we see some men who have grown grey-headed in the naval profession, who are any thing but seamen. The disagreeables of a young sailor's life are so great, that many people are reluctant to consign their children to the cock-pit, at that early age, when alone perhaps, they can thoroughly acquire the rudiments of seamanship.

The time for going to sea, is thus deferred till a later period, and the interval occupied in a

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course of education, which, however useful it might be, if taken to at a proper season, does by no means compensate for that want of early practice in the habits of a sailor's life, which is thereby incurred. This I take it, is one of the reasons, why many officers in the present day, are neither so fond of a ship, nor such good seamen as formerly. A squadron for performing evolutions even on so small a scale as I have recommended, would supply the deficiency of naval skill, arising from these causes, and might stimulate as well those who have already enjoyed the benefits of an academic education, as those who may hitherto have been negligent to inquire into those points, which though highly important, are too frequently left to the management of inferiors.

The evolutions of a fleet, it must be allowed, are connected with scientific principles, but the practical seaman is more likely to benefit from them, than the mere theorist. Even signals, which are so essential in naval operations, however plain and easy they may appear on paper, require frequent practice. I am not acquainted with the particulars of the new codes presented to their Lordships, but I am convinced, that the most simple will be found to be the best. The code

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originally established by the Admiralty was simple, and only wanted revision to make it answer every useful purpose. I have known my flag lieutenant trace a signal from a ship hull down in the wind's eye, by catching a glimse of the colour of a flag, when shape could not be distinguished. People accustomed to a fleet know the advantage of habit in the use of signals, and must be aware of the inconvenience of changing the number affixed to each signal flag, notwithstanding it may be adviseable to change the numbers of the signals in the presence of an enemy. The telegraph or semaphore, will admit of improvement, in an infinite ratio; it never indeed can be said to be complete, till orders can be communicated by it, with the same rapidity as by word of mouth.

In my third letter, I was anxious to call the attention of their Lordships to subjects connected with ship-building. I am a strong advocate for the encouragement of all improvements, that are not exclusive of existing merit; but at the same time, I would adhere to the models of ships whose excellence was already approved, in preference to launching into speculative plans, which have nothing but their novelty to recommend them.

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Mathematicians have long since discovered the curve line, which moving about a right line, generates the curve superficies, to which if that part of a ship within the water be shaped, it will meet with the least possible resistance, and by some writers, the artist is recommended to attend to this figure in shaping the hull. But the theory is not universally applicable, for this shape, however advantageous in some points of view, will not be found to answer all the purposes required in a ship of war. Some vessels do sail remarkably fast in smooth water, but bury themselves in a head sea; others make good weather, and rise like a murre on the waves, without having any good sailing qualities.

I am not certain that any form of the midship-bend, or of the water lines, is alone sufficient to insure velocity, whatever importance may attach to them in other respects. Look at a Lisbon Bean Cod, and some of our best sailing smuggling vessels, and it would not be expected, that they produce the effect for which they are so much admired. There is some knack of trimming them, and of placing the centre of effort of the sails in its proper place, which is the cause of any superiority they possess, and if these points were as-

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certained, as they might be, with mathematical accuracy, and adopted in our mould lofts, I think it impossible to doubt, that similar advantages would be the result.

We have in the navy some ships that are well proportioned, very handy, most excellent sea boats, and fully adequate for all purposes in the line of battle. A class of ships however, nicknamed the *Forty Thieves*, is one strong instance among others that might be adduced, of the lamentable defect in the theory of naval architecture. These forty ships were all built from the same draught, and yet each of them differed essentially in almost every quality from what was intended. Why this should be the case, I leave others to decide, but the fact is indisputable, and may partly arise from the custom of attending more to approximation, than to mathematical exactness. It is therefore most desirable, that mathematicians would lay down some general rules, by which as great a degree of certitude, as is possible, might be preserved, both in the make and properties of the most approved vessels intended for the same services; and also, that they should ascertain with precision, the most advantageous lines to be presented to the fluid, together with

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the proper place for the establishment of the motive power. These I think the great desiderata for fast sailing, and on these points, whatever difference of opinion there may be on the other topics of my letters, I fully expect the concurrence of every scientific seaman.

I have the honor to be, Sir,

Your most obedient servant,

CHARLES STIRLING.

J. W. Croker, Esq.

Admiralty.

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ADDITIONAL OBSERVATIONS.

The observations in the preceding letter, were originally intended as mere suggestions to the Admiralty; but I have now caused them to be printed for private circulation, together with three letters, written with similar views last year. I shall in this appendix, communicate the result of other enquiries, connected with the same subjects, and if by some, the enquiries are thought to be useless, or unnecessarily minute, I trust they will gratify the curiosity of others.

In the different books that have been written on naval subjects, there is a great deal of unsupported hypothesis; some of them are so interspersed with intricate calculations, or swelled with so much extraneous matter, or else are so very concise, that a seaman must consult a library, to obtain such information as he thinks it necessary

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for him to possess; whereas, the habits and fatigues of a sea-faring life, naturally incline men to unbend on shore in the amusement of society, without affording them the leisure, and the means, of pursuing studies, which develope the principles, and meliorate the practice of navigation. If therefore, I could aspire to write a manual for seamen, it should consist of a set of observations, which at the same time that they explained the principles of the naval science, should show their practical application to the mechanism of the profession: it should contain no hypothesis, that had not been demonstrated by experiment; no theory that had not been verified by experience.

I trust and hope, that in writing these letters, and distributing them to those, who I may fancy will be interested in the subjects of which they treat, I shall not be considered as dictating to those, whose authority I respect, or interfering with matters, which belong to distinct departments of the naval service. I hope also, I shall not be considered as affecting any extraordinary degree of knowledge. I have been at sea for the greater part of a long life; I was a Commissioner of the navy for a short time, and during the

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period in which I have been out of employ, my favorite study of subjects connected with shipping, has occupied and amused my leisure hours. I now offer for consideration, what I have often wished to be done, by officers better qualified, and with more influence than myself.

An objection seems however to present itself at the outset, to our naval improvement ever attaining any thing like perfection. The mathematician who calculates the difficulties which impede the labours of the artist, and suggests the remedies, sees the difficulties only in detail, and feels the effects not at all. He can only determine on what is before him; and the various forms which require to be united, in that wonderful and complicated machine a ship, are never brought at once under his view. It is thus, I account for the many errors into which writers on naval architecture have fallen, and till some great genius shall start forth, who shall unite a scientific knowledge of all the details, with a practical knowledge of their combined effects, I entertain but little hope, that I shall see these errors entirely removed. *

* The Courageux of 74 guns, although built from the lines of a favorite ship of the same name, taken from the French, laid on her side, with a moderate top gallant breeze.

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I have before observed * that the perfection of every kind of ship, may be comprised in the three qualities, burthen, stability, and swiftness. Now burthen has been supposed to be incompatible with swiftness, but so far is this from the fact, that the Caledonia, one of our large first-rates, beat every ship she sailed with at one time, and I take it a Collier might be made to sail faster than some ships of war, if the point where the effort of the wind, would have most power, was ascertained. We see bargemen, and even boys, in boats that are towed, who without any rule to guide them, shift their tow rope from one row-lock to another, till their craft steers well. Attention to the line of draught, is likewise found useful in moving bodies on shore, as well as those on the water; but the principle of the propelling power, which produces the same effect in a ship, is not sufficiently noticed. A mast is a lever for turning a ship on either axis, but not otherwise; it gives no progressive motion. A top gallant sail, will sometimes in a light breeze, have more effect than a course, but this has no connection with a lever, for the increase of power may proceed from the former being asleep, when the wind is

* Letter 3, Page 25.

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thrown out of the latter by flapping. When the breeze freshens, the top gallant sails will make the ship heel, and so soon as she does incline, her velocity will diminish, in the same ratio, as her inclination increases. The centre of effort of the sails can easily be calculated, whether more or less canvas is spread, and the seaman partly by guess, partly by observation, frequently finds it; but to make it exactly coincide with the centre of resistance, is a difficult, though necessary question to be solved. A knowledge of the higher branches of mathematics, can alone lead us to a scientific and precise result, and there is reason to hope, from the rapid progress of science, that this important desideratum, on which fast sailing so much depends, may be obtained.

The method in use for measuring the tonnage of ships, by multiplying the length of the keel by the extreme breadth, and the product by half the breadth, and then dividing by 94, is far distant from the true burthen for stowage. Originally it might have took its rise from an agreement between builders and buyers, but authority has long established it as a general practice. Formerly, there might have been some certain fixed and known rules for determining the princi-

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pal dimensions for building, and calculating the admeasurement when built: whereas now, that the length and the breadth are only taken into consideration, without any regard to the depth, the result is not only a very inaccurate computation of the true tonnage, but exceedingly unfavourable to naval improvement. It likewise interferes with that principle of construction, which promises velocity. The addition of one foot to the depth, would make no alteration. The merchant therefore naturally directs his ship to be built with as much depth as possible, to increase his stowage without additional expense. The ill effects of this I need not expatiate on. *

I give the tonnage of different vessels according to their true burthen, and as they are at present calculated, to shew the great difference.

The actual tonnage of the Victory is 1834 tons, and the supposed tonnage is 2143. She therefore carries 304 tons less than her measurement

* In assigning the depth of the hold for a man-of-war, it was usual to make it equal to half the breadth of the beam, but the form of the body should be considered on the occasion, as a flat floor, requires less depth, than a sharp floor. And likewise, when the centre of gravity is intended to be situated above the surface of the water, the breadth of the vessel, should always exceed double the depth.

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gives. The Diadem of 64 guns, carries 353 tons less than she measures.

	Tons.
The weight of the Vanguard of 74 guns, at light water mark is	1632
The weight at load water mark -	2273
Real burthen - - - - - -	1141
Tonnage by common rule - -	1604
Real burthen - - - - - -	1141
Difference - - - - - -	463

By which it appears, that this ship does not carry the tonnage she is rated at, by 463 tons, which is in consequence of her sharp body.

	Tons.
The weight of an Indiaman at her light water mark - -	659
The weight at load water mark	1641
Real burthen - - - - - - - -	982

The tonnage by common rule is 809 tons, which taken from the real burthen 982, leaves 173 tons more than she is rated at, which is in consequence of her body being formed very full.

Some Colliers measure 182 tons, and carry 354 tons.

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A cutter will show more strongly, the contrast between flat and sharp bodies, with respect to their tonnage.

	Tons.
The weight of the cutter at her light water mark is - - -	160
The weight at load water mark -	270
Real burthen - - - - - - - -	110
The tonnage as customary - - -	256
Real burthen - - - - - - - -	110
Difference - - - - - - - - -	146

Men-of-war have always less, and merchant vessels more tonnage, than they measure.

The weight of an 80 gun ship, when fitted for Channel service was thus.

	Tons.
The hull - - - - - - - - -	1593
Masts * yards, and studding sail booms	65
Other furniture - - - - - - -	130
Guns, carriages, and ammunition -	232
Provisions and casks - - - - -	800
Weight of men and ballast - - -	731
	3551

tons, equal to the displacement.

* The weight of the main-mast of this ship was 20 tons. Fore-mast 14 tons. Mizen-mast 6½ tons. Bowspit 7½

I believe it is generally supposed, that the weight of a ship, is nearly four-fifths of her tonnage by admeasurement.

The Commerce de Marseilles, which was brought away at the evacuation of Toulon, was 18 feet 8 inches longer on the gun deck, and had 2 feet 5 inches more beam, than the late Royal George, which was then one of our longest ships. The difference of tonnage was 537 tons. The whole absolute capacity of the former, was 5407 tons, and of the latter 3989 tons. During the war, we increased the size of our first rates considerably, but their capacity was not equal to the smallest first rate in the French navy, and yet the latter, are not so heavy rigged as our's, nor do they spread so much canvas. There seems to be at present an extraordinay propensity to enlarge ships. A ship, lately from Canada,

tons. The cube root of the weight of a mast is nearly the weight of its standing rigging, but the rigging is in general too heavy, and with other weights aloft, might be reduced. The patent levers used instead of fids for a first rate, are a very great weight. I have seen a fid, not heavier than the common fid, which a skilful mechanic might make answer for what is wanted, and without the danger of a disaffected sailor letting a top-mast down by the run, which he can do at pleasure with the levers.

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was 301 feet long, 50 and a half feet beam, 30 feet deep in the hold, and 3690 tons by admeasurement, but as an additional proof, of the erroneous method of measuring, she had 7300 tons of timber on board. She ran from the wind, coming across the Atlantic, but on her return to America, she foundered, whilst laying to, in a gale of wind. To what extent it may be attempted to carry the size of ships is uncertain, but it is quite certain that the increase beyond a given limit, will only hasten destruction. *

One inch capacity of the Commerce de Marseilles, at the load water line, was 24 $\frac{24}{35}$ tons, and of the Royal George, 21 $\frac{5}{35}$ tons. Of a 74 gun ship, 16 $\frac{7}{31}$ tons, and of the Jason of 38 guns, 12 tons. The Caledonia, carried her midship port 5 feet 7 inches out of the water, when she came out of Hamoaze, and the Ville de Paris 4 feet 8 inches. The Victory 3 feet 6 inches, when Lord Nelson last sailed from Spithead. The Hibernia did not carry her lower port near so high as was intended,

*The top timbers of a first rate, being made one inch bigger than was intended, occasioned 50 tons additional weight. The weight of the poop of this ship was about 30 tons. Of a 74 twenty-three tons.

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which unfortunately has been the case with many of our other line of battle ships. *

There is a great difference in the capacity of the fore and after bodies in some ships. In the Valiant of 74 guns, the difference was 297 tons. In the Revolutionaire, and some other frigates, above 100 tons. So much difference, must strain a ship, because the heaviest part is always pressing downwards, with a strain equal to the weight of itself. It will besides, produce violent and irregular movements, and consequently impede velocity. It is however, absolutely necessary, that a ship should swim by the stern, to diminish the faculty of griping, inasmuch as the water will by this means, be less obstructed in striking the rudder. † The difference of form, in the hind part of bodies, will of course affect the pressure, without increasing the progressive motion. The object should be, to have a free run from the ex-

* To know how much the guns will lighten a ship, divide the tonnage of a first rate by 10, the quotient will nearly give the weight of all her guns. Divide by 12 for two deckers, and by 14 for all others. The carriages will weigh about one-sixth of their respective guns.

† The bower anchors of the Pompee, brought her down seven inches by the head, and the foremast and bowsprit five inches

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treme breadth, and lessen the quantity of dead water, that is usually dragged after the ship.

The rudder is generally at the bottom, one-eighth, or one-ninth the breadth of the beam for large ships, and one-tenth for small ships, according to their breadth. A circular piece of about one-foot deep, and four feet long, fayed on the back part, where the force of the water is collected, would increase its power. The rudder should not taper towards the back, as it prevents the helm having effect, till moved one spoke of the wheel.

I have mentioned, * that the rake of the stem and stern post, is quite unlimited. It appears singular that mathematicians should be silent on a subject of such importance; and that this, as well as some other things, should be left to fancy.

An upright stem, admits of the water line beneath the surface, being made more acute, and of course, is better adapted for dividing the fluid; it likewise makes much more effectual resistance to a lateral impulse, and will more gradually resist the pitching motion. A sharp body, certainly plunges the most, but it is owing more to the wanting bearings at the harpings, than from be-

* Letter 3, Page 32.

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ing clean below. The greatest objection to this position, or having a large gripe, arises from the difficulty of wareing, and therefore the stem must be inclined more or less, according to the after body. Above the water line, it should be always perpendicular to the horizon, or it will increase the tendency to hog. *

When the stern post is placed at right angles to the horizon, the rudder will have the greatest effect in direct courses, but as the ship inclines, it soon loses part of its power, and if we suppose her to be on her beam ends, it will depress the head, without being in the smallest degree useful to make her fall off. On the contrary, when the post is inclined, the rudder has less effect, when the ship is on an even keel; but when she heels, the power of the helm is increased by this inclination, although the ship loses so much lateral resistance.

I likewise mentioned, † that our ships former-

* The more acute a bow is, the greater quantity of headsail is requisite, because notwithstanding a ship is less able to support it, the center of effort of the sails will meet the resistance of the water on the lee bow, when sailing on a wind. The Niger having a very sharp entrance, the foremast was moved aft, but she did not sail so fast, nor was she so weatherly as before.

† Letter 3, Page 33.

ly had a great tumbling home in the top side, but when an alteration was thought necessary, some ships had no hollow. The advocates for tumbling home assert, that the weight above the load water line, is thus brought nearer the middle of the breadth, and thereby causes the rolling motion to be more easy, and that this advantage sufficiently compensates for the inconvenience which narrow upper works occasion. The advocates for avoiding the hollow in the top side say, that tumbling home, makes a greater conversion of timber than is necessary, and there is a loss of strength, from the top timbers being grain-cut by crossing the natural growth of the timber; that the center of gravity on deck, will be the same in either case; and that any difference in the expense, from an increased consumption of timber, by expanding the breadth, above the line of floatation, will be compensated for, by the advantage of having more room to work the guns, or to do the business of the ship. And further, that the more round the side is, the wetter the decks are in a sea. But since the alteration, we certainly have found an increase of instability, and as therefore, our ships have for a long time, been too wall-sided, they require at least, some tumbling home.

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There is a method revived in ships, whose midship frames, are near half a circle, to join the floor timbers to an additional depth of keel, with a short hollow amidships. This certainly adds to stability, until the bottom of the keel is in the wake of the floor head; -- but no longer. The Belisarius, an American twenty gun ship, captured off the Delaware, when I commanded the Savage, by a squadron under the orders of Captain Duncan, was constructed in this way, with a sharp entrance, a large gripe, * a great deal of dead wood, no hollow in the water lines, and a circular piece to the rudder, without any hance. She sailed well, and was stiff in a moderate breeze, but did not answer all that was expected.

Of all round shapes, a globe, having a bias, or its centre of gravity, in a different point from the center of the sphere, seems to be the shape most likely to roll long and deep; and of all long bodies, a cylinder, is the most likely to answer the same purpose. Ships ought not to roll long and deep, and therefore ought not to be of this shape, unless an additional depth of keel,

* The larger the gripe, the more it must weaken the stem, by wounding it with bolts for security, and after all, it will bear but a small proportion to the body it is to assist.

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and sharpness at the extremities below, can be made to counteract the above defects. Should however, the buoyancy which a full body gives, be thought to lessen the evils of having much belly, and consequently have a preference, it should be recollected, that a body with a round bend, must principally depend for stability on the fore and after bodies, and that mischief may arise from having them too sharp, as well as by deepening the keel, if a ship should take the ground.

Some constructors go into another extreme, and sacrifice capacity altogether, by making the midship-bend, approach the shape of a triangle. This may do well for a yacht, in smooth water, but not for a man-of-war, which navigates the ocean, because in such ship, other essentials are requisite, as well as swiftness. The Termagant which I commanded in 1782, had a similar form, with a sharp entrance, and clear run. Whilst she carried top gallant sails, she sailed fast, and clawed to windward like a smack, but she made bad weather. It often happens, that ships celebrated for speed, labour much, and that others, which are dull, do not strain a rope yarn. Men-of-war should be easy, and therefore

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it would seem adviseable, that genius should be encouraged, to improve the rate of sailing, in good sea boats, rather than to project plans, which promise expense, without any other certainty.

The Licorne, taken by Admiral Keppel in 1778, had a straight breadth, at a certain distance beneath and above the water line, and she was crank. The Myrmidon of twenty guns, built at Liverpool, was of the same construction, and she would not stand on her legs. Other frigates that were full abaft, buried themselves when scudding.

It has been supposed, that an increase of length beyond the established rules of proportion, would at once augment the velocity, and the capacity of a ship; and that by this increase, not only might the center of gravity be lowered, if necessary, but the form would be thereby rendered better adapted for separating the line of support, from the center of gravity, and less liable to resistance from the fluid, when sailing by the wind. In practice however, these advantages have not been found the result. The Rainbow of forty guns, on two decks, commanded by my father, nearly sixty years ago, was afterwards

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lengthened, without any improvement in her sailing. The Prince of ninety guns, that was launched in 1786, was some years after, lengthened sixteen feet, retaining the same masts and yards, but with a proportionate, though erroneous alteration of the steps. Great skill was displayed in travelling her fore body in the dock, but after all, the Prince was always found to be a very inferior second rate. Since then, there has been a custom of lengthening ships in the frame; and the breadth has been expanded, by removing the cross spaleings, and allowing the timbers to fall out. This method, to say the least of it, is perfectly arbitrary, and owes none of the advantages it may accidentally possess, to science. In the late war, the bottoms of many ships were doubled, and the additional strength thereby obtained, was certainly found to be a great advantage, but the increase of breadth, from the additional plank, does not increase the capacity, whilst the sailing is not only injured, but the ships are rendered more leewardly under little sail:—an evil to be particularly guarded against in the construction of a line-of-battle ship.

But whatever opinion may be formed of either of these ships, no reasonable objection can be

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made to having the futtock the segment of a parabola, and suitable fore and after bodies, with other properties mentioned in my letters, as having been long known, and found to answer. A body laid down on such lines, with science to direct the artist, instead of analogy, approximation, and the scale of proportion, which have been too frequently substituted, would have so many advantages, that when the great alteration in the sailing of the Chatham * is recollected, there can be little doubt, that as such a ship was made to sail fast, all ships constructed on true principles, may be made to sail fast likewise. Our ships of war might then be confined to that size, which will alone allow of their being handy, and easy on their rigging, and thereby save an enormous and unnecessary expense of wear and tear. They will, in short, be able to carry their guns sufficiently high, to keep the sea in all weathers, carry a good helm, hold a good wind, and have advantages over all other disproportionate unwieldy ships, of the same class with themselves. Having obtained ships fit for the services required of them, and having indisputably the best seamen in the world, we should only want a squadron † to perform evolutions, and to

* Letter 3, p. 30. † Preface, p. 5, and Letter 2, p. 16.

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practise signals, to excel all nations in naval tactics, and to make Great Britain look with increased confidence to a future war.

In alluding to the excellence of our seamen, I must take occasion to express my regret, at the difficulty which there now seems to be in properly manning our ships of war. This would appear the almost necessary consequence of a state of peace, unless counteracted by some plan which should keep alive the activity and skill of those, whose services may be required in a time of exigency. An experimental squadron constantly kept afloat, would soon make all the raw part of the crew of a guard ship, good for tops, and in time for the forecastle. Nor would it be less beneficial to young officers, than to men before the mast. It would teach them to handle a ship, to take the helm, and the lead. I have myself seen the ill effects of the want of this sort of skill. When I was lieutenant of the Defence in 1778, there were very few, out of 600 officers and men, who were competent to their duty; and even now-a-days, in many a coaster, the tending of a ship at single anchor, is from constant practice, better understood than in a King's ship. The more we consider what may be done by

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steam vessels, in the event of a war, the more evident will be the necessity of a constant succession of practical experiments, to enable us to resist their attack, when in the hands of an enemy, and to make the most of those advantages, when in our own. These experiments, I may confidently predict, will be of more real service, than all the remembrace of our former victories; which though it may keep up the spirit, will contribute nothing to the skill of our seamen. An officer fully equal to the command of a single ship, may lose all the advantages of courage and talent, from not having had sufficient practice in the evolutions of a squadron; and in the line of battle, a hero may be baffled by the superior skill of his adversary.

It was customary in the early part of the revolutionary war with France, to have floats affixed, for knowing the draught of water; but in harbour they were useless, and at sea, they only served to mislead. If a syphon was put at the keel, having one end placed as the tubes for the floats are, and its short leg, with its mouth forwards, the force of the water running aft would raise the water within board, above its level; and if the mouth of the short leg was turned aft, the

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water within board, would be lowered. Now these tubes, may in some measure, be considered as syphons, for when the ship sails by the stern, the after part of the hole, presents a greater surface to the force of the fluid, than the fore part, consequently the water will lift the float, and more so in the after, than in the foremost tube. It therefore appears, that this apparatus may seem to make a ship draw more water abaft, at the time she is actually depressed forwards. This, though of trifling importance, is an additional proof, that the soundness of an opinion should be ascertained, before it is acted on. People are so biassed by one motive or another, in the opinions they are called upon to give, that it is difficult to know when we have one sufficiently sincere and impartial, to be implicitly relied upon.

There was likewise at that time, a capstan brought forward, with a great increase of power, from the application of friction wheels; but it was expensive, liable to injury, and not easily repaired abroad. The common capstan will break a messenger, and if power be wanted to weigh an anchor, a purchase is easily applied. Line-of-battle ships, in ordinary, are moved from

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port to port with only 100 men, and a whip purchase is clapped on the cable, if an anchor does not come easily out of the ground.

The friction of the common capstan, from a large surface being presented to the partners, is equal to one fourth of the power; but this might be remedied at a very cheap rate, by the adaptation of an iron spindle. There certainly is difficulty in discovering a burn or other flaw, as well as danger of calcining the heat of a bar of iron, of even four inches diameter, but the art of forging, is brought to such perfection, that four pieces of iron might be welded together, to make a spindle sufficiently strong, and be unexceptionable. Whelps might be added, or taken off, according as time or power is wanted.

In the experiments made by Mons. de Romme, * to determine whether the obtuse, or the acute end of a block, met with the greatest resistance, in its passage through water, there was not the consideration, which might have been expected, from a man of such knowledge. The manner in which the experiments were made, were far from being unexceptionable: the bodies used, were not of sufficient dimensions, neither were they made to pass through the water with

* Letter 3, Page 42.

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sufficient velocity, which in small models, is alone sufficient to make friction give a bluff entrance an advantage over an acute one: nor did they acquire a uniform motion. The heaping up of the water at the fore part of the solid; the depression of the water at the stern; and perhaps the action of the water at the head and stern, might prevent the solid from being parallel to the horizon. These circumstances, which unavoidably attend experiments made on a scale not sufficiently large for the occasion, were probably the cause of an opinion since found to be erroneous, respecting the station of the midship bend.

Mons. de Romme fell also into another error, when he stated, that as the limits to which the center of gravity in a ship was very strait, a great change in the stowage of the hold will produce a very trifling difference in the stability. Every seaman knows that it does make a great alteration. The Navy Board consider stowage of such importance, that the Masters Attendant, are directed to arrange the ballast to a given plan, and the captains make returns of the qualities of the ships they command, as well when under sail, as at anchor. It is not however, generally un-

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derstood, what the exact distance should be, between the center of motion, and the center of gravity, which a ship requires when stowed, so that the distance between the two centers, should not be so much, as by the length of lever, will make the ship too stiff, and have sudden motion, nor too short, to prevent her being able to carry sufficient canvas, but the center of gravity of the body immersed, should be made to fall perpendicularly under the center of gravity of the ship, and at such distance from the upper water line, that the metacenter may fall into its determined place.

It is the opinion of some people, that there are no limits to the improvements of science, but the supiness of those who undertake the pursuit; and consequently, that there is no excuse for any error in ship-building. Without exactly going this length, I may be of opinion, that there is still room for a great advance. The application of that branch of mathematical analysis, termed Differential Calculus, not hitherto, I believe, in general use, would lead to a minute accuracy of calculation which would remedy the existing defects in many of the points I have instanced. Surely also, it is possible to amend the method of

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measuring the solid contents of the immersed body, as well as to avoid the strange variety we see in ships of the same class, and even of those built from the same lines, and to find a substitute for the present absurd mode of casting their tonnage: a mode, be it observed, that determines no one thing whatever. Generally speaking, no ships are so well put together as British men-of-war, and it is with no intention of disparaging those who construct them, if I express my wish, that the aid of philosophy, in the true sense of the word, was called in to the subject.

The round sterns seem likely to become very common in the navy. It must be allowed, that they occasion ships to send aft, when riding in a head sea, more than when the sterns were constructed in the former fashion, and that they expose the rudder too much in action. This latter objection however, might be diminished, by not having the hance above the surface of the water, or indeed by having no hance at all. In every other respect, the superiority is indisputable, and in an attack from steam vessels, they will present a formidable battery abaft. By this means, together with the improvement in admitting the bow guns to be pointed well forward,

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our ships no longer have, what has been aptly denominated, an angle of impunity.

We probably never shall see such beautiful ships again as the Victory, Russel, Centurion, Aurora and Swallow were, between fifty and sixty years ago, but a great improvement in appearance has taken place, since the fan tails have been disused, and this is to be attributed to the use of the round sterns. The French ships in general, look warlike, whilst our ships with upright sterns, have nothing to catch the eye, in spite of the determined superiority of our workmanship. Looks, it may be said, are only of secondary consideration; but looks are not to be neglected, and many a sailor has entered the service, because his eye has been gratified by the graceful and beautiful sight of a ship on the water. Besides, seamen take a pride in the beauty of their ship, and the whims of a useful, but capricious set of men, should not be slighted. I am not indeed, for abridging any harmless gratification, of whatever sense it may be the object. *

* When carving was in fashion, it was done for two shillings per ton. It was then customary to place the forepart of the figure of the head, at a distance from the rabbet of the stem, equal to the space between the lower part of the wales, and top of the side.

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It is somewhat surprising, that more attention has not been paid to the growth of Oak in this country, considering the quantity that is necessary for home consumption. I am aware that the British Oak, however great its name, is not the best timber in the world, but still, if it be admitted, as I have suggested in my various observations on the dry-rot, that no wood can be depended upon, unless its root, or place of growth has been examined, British oak will possess advantages, which cannot be expected in foreign timber. To raise the necessary supply for our dock yards, taking the consumption at 50000 * loads annually, will require 170 square miles, equal to 109186 acres, to admit 1092 acres, to be felled every year. The Royal Forests contain about 116000 acres, 7000 of which are supposed to be independent of any private claim. Nothwithstanding which, I understand that for 50 years, the crown lands, only supplied the navy with 2000 loads annually; whereas under good management, the New Forest alone, might be made sufficient for the whole supply of Ports-

* By a mistake of the printer, I am made to say, at page 11 of the letters, that 200000 loads is the annual consumption.

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mouth yard. In England, the forests and chases contain 306000 acres. I do not know the quantity in the other parts of the United Kingdom. The best British oak, is grown in Sussex and Kent, not excepting what is grown in the Forest of Dean, which on that account, has been called the garden of the world. In Wales, the trees are small, but the wood is hard and good, when not injured by lopping. In Scotland, very little dependance can be placed on the oak timber, from the very pernicious system that prevails there, of not grubbing up the roots of trees, that have been thrown down, but permitting new plants to spring from the old stocks, most of which, on being brought into use, are found to be unsound. The only good oak in America, is grown in the Florida's, but it is of small scantling, and nothwithstanding its character of incorruptibility, the Congress, an american frigate built of it, which took a sloop of war under my command in 1781, proved defective. In some parts of Languedoc, where the soil is a stiff loamy earth, or clay, rather dry than otherwise, and where they are tolerably sheltered, both from sun and wind, the oak is equal, if not superior to our own. The Pompée, built at Toulon

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with this oak, was very sound when broken up, after much hard service for many years. In other parts of the South of Europe, the oak is not so good; and indeed, wherever the grounds are low and marshy, or the soil loose and sandy, and produce trees of quick growth, the timber is weak and subject to decay. *

* Since these pages were put into the printer's hands, my attention has been called to an oak tree, felled at my farm, with fungus in the very heart of the root. One side of the root is sound; the other side and top, quite rotten. The parts affected crumble into powder between the fingers, but the whole trunk of the tree is to all appearance perfectly sound. I have shewn it to several, who are supposed to be well acquainted with timber as a marketable commodity, and they say that its appearance indicates no defect whatever.

I am told, that the appearance of fungus, which is often discovered in the butt of a tree when split, after the trunk has been sawn off, is sometimes thought of so little consequence, that it is stacked up for use, as if perfectly sound. This I apprehend to be dangerous, and the risk perfectly unnecessary. Since I have lived in the country, I have felled timber, which looked well, but after being some years in the ground, exhibits fungus, and every appearance of dry rot. In some close places where the fungus is on the outside, and the internal parts unaffected, I have known the evil checked by the removal of the fungus, and the admission of a free circulation of air; but this I consider could not be effected, if the seat of the disease were found, as in the cases I have just stated, in the heart of the timber. Great there-

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The longest lived ship we ever had, was the Royal William of 84 guns, on three decks. She was built in 1718, and when broken up lately, her floor timbers, and most of her futtocks were perfectly sound. I cannot avoid mentioning, though rather irrelavant, three other remarkable circumstances in this ship. The standing rigging, made for her of white cordage, lasted in constant service in her, and in the Sheer Hulk at Portsmouth, for 30 years: the main mast was of one stick, grown in Scotland; and she had beech plank, 5 strakes from the garboard strake, which was sound after being on 52 years.

The average size of trees, used in the King's yards, is 80 cubical feet meeting. Fifteen hundred and sixty of such trees, are used for a 74 gun ship, which in its rough state, is nearly one-sixth loads, for each ton burthen; but as little more than half that quantity is usually put into a ship, since wooden knees and standards have, for a reason presently mentioned, been disused, the remainder is applied to general purposes.

fore, as are the advantages to be derived from attaining a circulation of air through every mass of timber, whether only stacked in a yard, or actually made up, and much as it is to be recommended, I cannot take upon myself to say it is a remedy for the dry rot.

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Now the number of trees that grow to perfection on one acre of ground, is about 35, standing 30 feet asunder, and therefore 50 acres will be requisite to produce the quantity of timber necessary for such a ship. The 1560 trees will be thus divided ;—for the timbers 700 ; the lower deck 80 ; the upper deck 60 ; and the remainder will be disposed of in the other decks, beams, planking, &c. *

The timber used for knees and standards, has of late years, become very difficult to procure. A 74 will take about 500 knees, and although most of them, are converted from whole trees, they do not contain at an average, more than 10 or 12 solid feet. Iron has therefore been introduced, as a substitute, with a very considerable saving of expense. Indeed, the use of iron, has lately been considerably increased in our ships since the improved method of welding, and preventing calcination, has rendered the metal more to be depended on than formerly. It must not however, be forgotten, that the danger from the attraction of the electric fluid, and likewise from

* If the whole sum for building a ship, be estimated at a given price, then one-half of that sum is allowed for planking ; one-fourth part for the decks ; one-eight part for timbering ; and the remaining one-eighth for finishing.

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the effects of shot striking the iron fastenings obliquely, is thereby rendered very great.

When two pieces of oak and iron are of the same weight, the wood is twice as strong as the iron; but when of the same size, the strength of iron to wood is as 9 to 1, and they increase in strength nearly as the square of their sides, or diameters. The wooden lodging, and hanging knees for a first-rate, with the standards of the upper works, would weigh about 64 tons, whereas iron knees and standards, would only weigh about 43 tons.

The building of ships in the King's yards, has so many advantages, that it is to be hoped, no recourse will be had in future to contracts. Ten sail of the line, * with a proportionate number of frigates, might be built annually in our dock yards, besides the repairs; and this, whilst it would keep up a proper number of serviceable ships, would reduce the expense nearly one half. And besides the saving in first-cost, in ships built in the King's yards, there would be a greater probability of the timber being better

* Forty-one men will build a seventy-four of 1730 tons, in 313 days, at £2 14. per ton, each man earning 7s. 6d. per day, working 3 days for one. The Pegase of 74 guns, taken in 1782, was built at Brest in 90 days.

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seasoned, and the materials of a better quality generally, than those found in a merchant's. If a ship built in the former, will last 15 years, I think 10 will be a sufficiently long life, to allot to one built in the latter. As to repairing a ship, if it be done thoroughly, it generally costs more than building a new one. The Lion of 64 guns, was built for £21353, and on being repaired by contract, for 10 years' service, she cost £65109. The Africa, another 64, cost in building £25047, and when repaired for 5 years' service, £33168, was laid out upon her. * It has been sometimes thought advantageous, to take off a deck from a line-of-battle ship, when the upper works are weak, but it is certain, that if the body was originally formed according to rule, the alteration must interfere with qualities requisite at sea. A similar objection will hold to frigates, built on the keel of a line-of-battle ship. To use the phraseology of a dock yard, such ships, with

* Parliament used to allow for the expense of the navy £4. per month for every man employed, and it was thus divided. Wages 30s. Victualling 19s. Ordinance 4s. Wear and tear 27s. From the increase of wages and provisions in 1797, the expense was estimated at £7. per man, and the whole expenditure of a ship of war at £33 per ton. Extraordinaries, building, ordinary repairs, &c. are not included.

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others before mentioned as objectionable, have no system. I may further observe, that when the top-side has not a proportionate height, the masts must lose support, and the danger therefore will be increased, by the additional length of lever above the metacenter.

To give an instance of the difference of expense between building in the King's Yards, and in the merchant's, the Milford, of 74 guns, was built at Milford Haven at £ 20. per ton, when the contract price had risen about that time, from £ 24. to £ 26. per ton. In 1792 the contract price was £ 17. 5s. per ton.*

Another objection to the merchants' yards is, that caulking, the importance of which nobody

* The estimate for building the Dreadnought of 98 guns, in 1799, in a King's yard, was thus ;---

	£.	s.	d
Hull measures 2110 $\frac{53}{74}$ tons, at £22 per ton.	46432	8	1
Copper bolting	2600	0	0
Coppering	1709	0	0
Masts and yards	2059	0	0
Pumps and other furniture	263	7	6
Hull, masts and yards	53063	15	7
Fitting the rigging	93	14	0
Rigging, and sea stores	10246	16	9
Total	63404	6	4

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can question, is seldom so well attended to, as in the King's. In this operation, great care should be taken, that the oakham is bottomed home to the timbers in new ships, and in caulking old ones, the seams should be cleaned, by reaving out what is wet or decayed, and driving home to the timbers, what is good and dry.*

I think too, the system of contracts might be advantageously abolished in the supply of cordage and canvas. Surely manufactories for these articles might be profitably established in our dock yards. We have already one instance of this, in the manufactory for blocks at Portsmouth. The steam engine, which is used for emptying the docks, enables 80 men to make twice as many blocks in one year, as are wanted for the whole fleet, and at half the cost,

* The quantity of oakham used in a ship is 10 Cwt. to every 100 tons burthen. A frigate takes one-fifth of the whole for her upper works. Thirty men will by job-work, caulk a first-rate on the stocks in 66 days. A 74 in 55 days. A 32 in 24 days, and a large sloop in 21 days. One man will caulk of old work in a single day, 76 feet of deck, 60 feet of water ways, wales, and bottom, including horsing up, and reaving, but not spileing; and 69 feet of upper works. The greatest quantity of caulking which one man has been known to do in a day, is 3 for 1, and two tides.

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which government paid before for very inferior articles. Many coils of rope, and bolts of canvas, were so bad last war, that they were returned to the contractors, and what was retained, was frequently so indifferent, that even an additional expense would not be an object to procure better materials, and there can be no doubt, that the supply might be made equal to the demand. In 1795, the price of rope was £ 2. 2s. per Cwt. In 1800, the cordage made in the King's Yards, cost £ 8. per ton, whilst the contract price, was as high as £ 14. Government finding the hemp. In 1808 the price of rope rose to £ 250. per ton.*

It must be admitted, that the manufacture of

* In 1800 there was supposed to be about 3636 tons of hemp used for the navy, that might be grown on 2000 acres. The whole consumption of hemp in Great Britain, was 40000 tons. In feeding yarns, when making rope, much care is requisite, for if the tar is too hot, it will over-heat, and burn the yarn, and if too cold, it will overweigh, and clog it. A single rope yarn, should support 84lb. and in making of rope, Mons. du Hamel, recommends to work up the yarns to three-fourths of their length. In the King's rope, there is put a mark yarn to prevent embezzlement, but as this may be taken out at little expense, it would be better, if the public yarn was spun contrary to that which is provided for merchant ships.

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copper at Portsmouth, is not so successful as that of blocks. It supplies all demands from the other yards, but the pigs of metal, having an intermixture of heterogeneous substances, when received into store, there has been no method yet adopted, to get rid of the impurities. An experiment lately tried on the copper of the Dartmouth, which had been sheathed little more than two years, tends to prove, that a galvanic influence, by the application of iron, will protect the whole body of the copper, but does not prevent the adhesion of barnacles and weeds, as her bottom, and particularly about the protectors, and in the run, was so foul, that the ship would hardly steer on her passage from the West Indies. The aim of the metallurgist should be, to separate pure copper from the ore. Unfortunately, the navy does not derive the the benefit chemistry might supply. The real fact is, that as copper has a great tendency to unite with a number of metallic substances, the process of obtaining the metal in a perfect state, by roasting, smelting, &c. is very troublesome, and as the metal when alloyed, soon becomes unfit for use, the demand is thereby increased, and the price enhanced; and consequently, it is

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the interest of dealers, who have large quantities for sale, that copper should not be sent into our arsenals, in a state of purity. I remember the Swallow in India, in 1775, whose copper sheathing after having been in use for 7 years, was perfectly clean, although some parts were worn as thin as a sixpenny piece. Some other similar instances might be mentioned, and even of copper supplied by contract, being better than what was rolled into sheets at Portsmouth, but in most cases of late years, copper sheathing soon gets foul.*

The composition bolts and nails, are usually preferred to copper, from its being thought too soft for the purpose required; but the polarity of the parts of copper, makes it much better disposed for malleability, and therefore bolts made from copper, are the strongest for driving. This is to be understood only of pure malleable copper, for if there was a very small mixture of lead, the metal would become exceedingly brittle. ||

* A first-rate will take 4429 sheets of copper, equal to 17 tons for sheathing, with 1 ¾ tons of nails. A 74 takes 3262 sheets, equal to 12 ¼ tons, with 1 ¼ tons of nails. A 32 takes 2275 sheets, and a large sloop 1148 sheets, for their bottoms.

|| A first-rate will take 36 tons of copper for bolts. A 74 takes 17 tons of copper bolts under the water line. Before the use of copper bolts, the usual quantity of iron put into

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Every officer who recollects the sails supplied by contract, will be glad to see another mode adopted. The sail-makers in the naval yards however, do not equal many workmen in the cut of a sail, and gathering in of the bolt rope; but great improvements have certainly been lately made, though I regret to say, that the rules by which sail-makers are guided, are not of that precision, which can alone insure success to their workmanship.

There has been a great deal of controversy about the comparative ability of sails, that have much spread, and taunt sails. Some experiments, made by the late Mr. EDGEWORTH, on the resistance of air, seem decisive respecting sails placed at right angles to the wind. He contrived an apparatus, consisting of a parallelogram, made of a pliable substance, which could be moved with any degree of velocity, and placing it first, with its shortest side, and then with its longest side parallel to the horizon; he found that the former met with more resistance from

a three decker, was 1 and two-third tons for every 100 tons burthen In two deckers 1 ¼ tons was allowed. Single decked ships had 1 ton, and for every odd 20 tons, 1 Cwt. was allowed. The sizing of bolts has no rule. Bolts three times as long as others, are of the same diameter.

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the air, than the latter, in the proportion of 10 to 9. He then formed the parallelogram into an arch, and the resistance was greater than when flat, in the proportion of 11 to 10. From this experiment, it would appear, that a taunt sail, has an advantage over a sail that has much spread, when going large, and still more so, if it is allowed to have a slack leech. But when a sail is placed obliquely to the wind, its surface ought to be as flat as possible, otherwise it will form a kind of bag towards its foot, in which the wind will lodge, and scarcely serve any other purpose than to make the vessel incline. Indeed it often happens, that the part of the sail near the clue, when the sheet is hauled aft, proves entirely a back sail, and is of great disadvantage. To the consideration of this, perhaps we owe the improvement that has lately crept into the naval yards, of making the seams to run parallel, instead of allowing for a belly. The gathering in of the bolt rope, is still left to the caprice, or discretion of the sail-maker, who allows what he thinks proper, for the stretching of the rope, but as the goring cloths, stretch more, from drawing anglewise, than when they are square, great judgement is requisite, to know the additional quantity of canvas to be gathered in bolting.

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Stay sails have generally too much hoist, and too much after leech, owing to which, except a ship is going lasking, they throw the wind out of the other sails; but if they were reduced, and made to set flat, they would not only be useful when sailing from the wind, but likewise when on a bow-line. The clue should be so rounded, that the sheet is brought in a line with that part of the sail, where the effort of the wind is collected. *

I never understood the principles of the canon, by which is cast the dimensions of the component parts of the hull of a ship, together with the anchors and cables, and the proportion of

* If the length of the gun deck in feet is squared one-third of the product will nearly give the quantity of canvas in yards, contained in one complete suit of sails. The canvas for a first-rate will weigh 7 tons, and the bolt ropes, and twine, I ½ tons. One bolt of canvas, No. 1 should weigh 44 lbs. and every bolt to No. 8 successively, 3lbs. less. To estimate the strength of canvas in King's yards, they cut off one inch from the end across, and if No. 1 bears a weight of 320 lbs. it is received. Ten men working 5 hours, which is a single day, will complete 8 months' proportion of sails for a first-rate in 160 days. A 74 in 147 days. A 32 in 87 days. and a large sloop in 46 days. By task work, for which the men get 3s. 8d. for sewing 100 yards, they will work 2 ½ days in one, and sew 150 yards.

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masts, yards, and rigging, but I have made for my own use, calculations with great ease, which give the dimensions of most things in a 74, from the keel, to the mast head, sufficiently exact; and when a dock yard was under my controul, I had seldom occasion, to have recourse to a ship-wright's book, a carpenter's abstract, or a boat-swain's rigging warrant. For running rigging, the calculations were usually more convenient, than to reeve and cut.

I am equally ignorant of the rules by which masts are placed, but I fancy it is customary to have the step of the fore mast one-seventh the length of the water line, from the aft part of the rabbet of the stem; the main mast one-fifteenth of the same length, abaft the middle line; and the mizen mast two and two-thirteenths before the fore part of the rabbet of the stern post. The bowsprit steaves 25 degrees, but the French bowsprits steave considerably more, and the Americans' less. These rules, whatever they are, as well as those by which the proportions are cast, will be altered, whenever the subject comes under proper consideration, for according to the present mode, if a great ship be properly masted, the smaller one cannot be so likewise.

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Admiral J. Levison Gower, in one of the armaments before the late war, tried experiments on the stability of different ships, by the men and guns, to cause heeling, but no practical result followed. Every thing respecting displacement might be calculated, but the momentum aloft, necessary to give a certain inclination, must be ascertained by actual experiment, and then the area of the sails, with the dimensions of the masts and yards, may be determined. And having found the proper height for the masts of a 74 gun ship, of 1730 tons, being certainly the best, and perhaps the only well-proportioned class of ships on two decks, the mathematician will easily calculate the height of any other masts. I risk the hazard of being charged with repetition, when I recall the attention of my readers, to a concluding observation on the important subject of the situation of the motive power. I look upon this, as a point of greater consequence, than any of the numerous topics on which I have touched. Little understood or attended to, as it is at present, I repeat that without due attention to its situation, the finest vessels will not answer expectation.

Desultory as the above observations may seem, they are connected with the various subjects in-

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troduced in my letters to the Admiralty, and would more properly have formed a part of them, but for the desire I felt, to be as concise as possible. As they now stand, I hope they will not be uninteresting to those, into whose hands these pages may fall. The simplest observations have produced the most brilliant results. Nor, whilst I recollect, that we owe the theory of the reflection and refraction of the rays of light, to the apparently childish occupation of blowing soap bubbles in the air, with a common tobacco pipe, shall I think the most trifling hints, on any thing connected with the Navy, altogether useless and in vain.

CHARLES STIRLING.

Woburn Farm, Chertsey, February, 1827.

Castell, Printer, Chertsey.

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ERRATA.

I subjoin a list of Errata, which from the carelessness of the printer crept into the various copies of the three former "Letters," and which I did not see in time to correct.

Page 11,	line 54,	for 200000 loads,	read 50000
. . 12,	. . 26,	. . order	cover
. . 16,	. . 6,	. . rate	rates
. . 23,	. . 6,	. . ever	even
. . 29,	. . 26,	. . free	fair
. . 31,	. . 12,	. . immerge . . .	emerged
. . 31,	. . 15,	. . sides	sill
. . 32,	. . 17,	. . make	rake
. . 32,	. . 19,	. . make	rake
. . 33,	. . 20,	. . timber	timbers
. . 34.	. . 1,	. . either	others
. . 42,	. . 16,	. . extreme . . .	entrance
. . 45,	. . 24,	. . bottom . . .	bottoms
. . 49,	. . 16,	. . fœdid	fœtid
. . 69,	. . 8,	. . longest	largest
. . 76,	. . 20,	. . clear, ...	clean
. . 91,	. . 6,	. . irrelavant. . .	irrelevant

N. B. In letter 1, page 11, the printer has made a strange mistake. In my letter to the Admiralty, I thus expressed myself. "I have understood that 200000 loads of English oak, with about 10000 of foreign timber and plank, was the amount of the annual consumption *for all nautical purposes. Out of this, about* 50000 *loads was consumed* in the King's yards." By leaving out the words printed in *Italics*, I am made to state in the printed letter, what is obviously incorrect.

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9-8

Wilmot Hawksworth Fawkes.

Royal Navy.

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